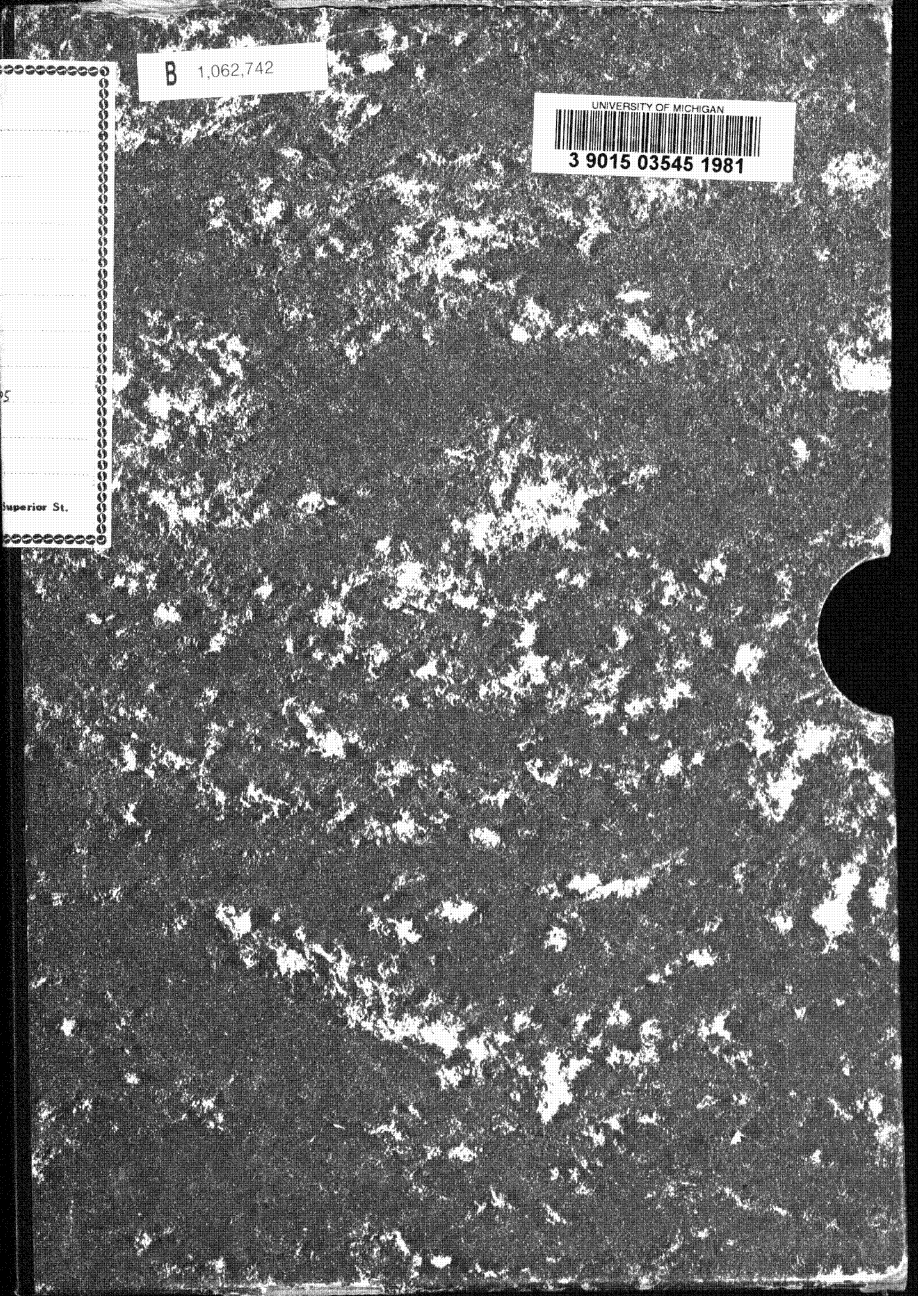


COLLEGE OF HAWAII PUBLICATIONS

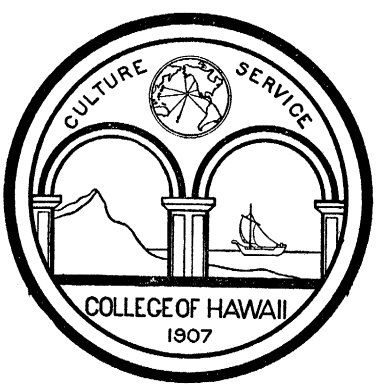
BULLETIN NO. 4

PALMYRA ISLAND WITH A DESCRIPTION OF ITS FLORA.

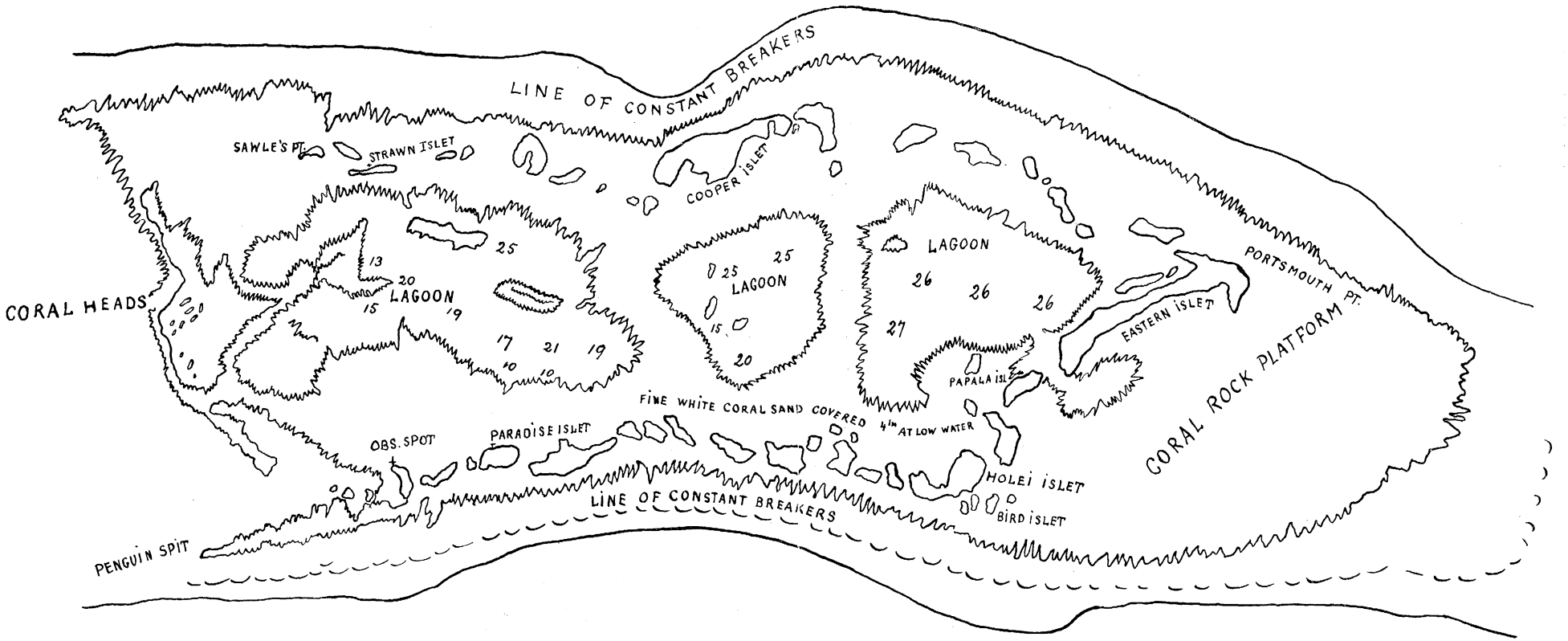
BY

JOSEPH F. ROCK

With the cooperation of O. Beccari, A. Zahlbruckner, U. Martelli, H. L. Lyon and M. A. Howe



HONOLULU
PUBLISHED BY THE COLLEGE
APRIL 19, 1916.



PALMYRA ISLAND

SOUNDINGS IN FATHOMS

1913

LAT. N. 5°49'04"
LONG. W. 162°11'29"

COLLEGE OF HAWAII PUBLICATIONS

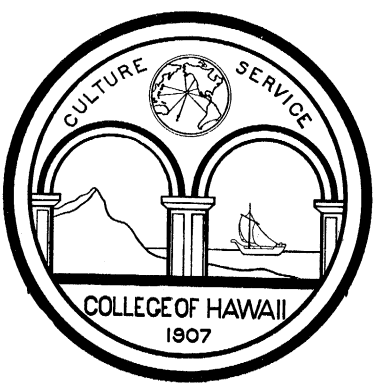
BULLETIN NO. 4

PALMYRA ISLAND
WITH A DESCRIPTION OF ITS FLORA.

BY

JOSEPH F. ROCK

With the cooperation of O. Beccari, A. Zahlbruckner, U. Martelli, H. L. Lyon and M. A. Howe



HONOLULU
PUBLISHED BY THE COLLEGE
APRIL, 1916

TABLE OF CONTENTS.

PREFACE

Little or practically nothing was known regarding the natural history of Palmyra Island, an American possession in the north Pacific Ocean, though visited several times by various persons. All the reports brought back by these parties were rather meager and dealt mainly with commercial possibilities. The following pages are the result of a more or less thorough investigation carried on during a stay of sixteen days on the Island. While, of course, not complete in data it is hoped that the facts published herewith will add to the general knowledge already existing about coral atolls.

J. F. ROCK.

Honolulu, T. H., April 10, 1916.

HISTORY OF PALMYRA ISLAND*

Palmyra or Samarang Island was discovered by Captain Sawle of the American vessel *Palmyra* on November 7, 1802. Since that date it seems that the island has been visited only at long intervals. According to the records found on the island by the Hawaiian Commission in 1862, Palmyra Island was taken possession of for the United States Government by Dr. G. P. Judd, the agent of the American Guano Company, who visited the Island in the brig Josephine. A notice to that effect and the American flag were left on the Island. The following is a copy of the notice:

BE IT KNOWN TO ALL PEOPLE

that on the 19th day of October A. D., 1859, the undersigned, Agent of the American Guano Co., landed from the brig Josephine, and having discovered a deposite of guano thereon, doth, on this 20th day of October aforesaid take formal possession of this Island, called "PALMYRA" on behalf of the United States, and claim the same for said company.

(Signed) G. P. Judd
Agent A. G. Co.

Witnesses:

C. H. Judd
R. Drysdale, M.D.
W. C. Stone.

On Wednesday, February 26th, 1862, the Hawaiian Cabinet Council met at the Palace, with the King (Kamehameha IV) presiding, consisting of Prince Lot Kamehameha, Chief Justice Allen, Mr. Griegg and Mr. Wyllie to consider a petition from Z. Bent and J. Wilkinson, requesting that Palmyra become a Hawaiian possession under the Hawaiian flag. This petition was granted, notwithstanding the fact,—of which the Hawaiian Government appeared to be ignorant,—that Dr. Judd had taken possession of Palmyra in the name of the United States three years prior to the reading of this petition.

The following is a copy of the Commission of Zenas Bent:

Kamehameha IV. By the grace of God, of the Hawaiian Islands King:

To all whom it may concern:

KNOW YE, that we have authorized and empowered our faithful subject Zenas Bent and by these presents, do hereby empower the

* The history of Palmyra was compiled from documents in the government archives of Honolulu and other sources.

said Zenas Bent to take possession in our name of Palmyra Island, the said Island being situated in longtitude 161° 53′ west and in latitude 6° 4′ north not having been taken possession of by any other government or any other people, by erecting thereon a short pole with the Hawaiian flag wrapped round it and interring at the foot thereof a bottle well corked containing a paper signed by him in the following form viz:

Visited and taken possession of by order of His Majesty King Kamehameha IV, for him and his successors on the Hawaiian throne by the undersigned in the Schooner Louisa this day of..... 186.....

In witness whereof we have hereunto set our hand, conjointly with our Kuhina nui and caused the great seal of the Kingdom to be affixed this 1st day of March A. D. 1862.

(Signed) Kamehameha

Kaahumanu.

By command of the King and the Kuhina nui

L.Kamehameha.

(Seal)

In transmitting this commission the Minister of the Interior wrote to Bent and Wilkinson as follows:

Interior Office,
Honolulu, March 1st, 1862.

Gentlemen:—

I am instructed by His Majesty's Government to acknowledge the receipt of your petition of the 24th ult. and to inform you that in Cabinet Council held on the 27th ult. at the Palace the above mentioned memorial was considered and discussed and I am authorized to state on the part of His Majesty's Government that they consent to the taking possession of the Island of Palmyra, situated in longitude 161° 53′ west and in latitude 6° 4′ north as described by you in said memorial, for the purpose of increasing the trade and commerce of his Kingdom as well as offering protection to the interests of its subjects.

I have the honor to forward with this dispatch the authority under the Royal Sign Manuel to Zenas Bent, Esq. to take possession of the above mentioned Island of Palmyra, and beg to request that you will after having executed the orders contained in the commission, you will report the fact to the Department. Hoping that the enterprise may prove successful, I beg to remain,

Gentlemen,

Your obt. servant,

L. Kamehameha.

To Messers. J. Wilkinson and Zenas Bent.

It appears that Capt. Zenas Bent sailed on or about the day on which the commission was dated, for Palmyra, to take possession in the name of the King. A pole was erected with the Hawaiian flag wrapped around it and a bottle was buried at the foot of the pole containing a paper signed by Zenas Bent which read as follows:

"This Island is taken possession of by order of His Majesty King Kamehameha IV. for him and his successors on the Hawaiian throne by the undersigned in the schooner Louisa this 15th day of April A. D. 1862.

(Signed) Zenas Bent"

The following paragraph comprises Captain Bent's report to the Department of the Interior:

"By correct observation I found the Island to be latitude 5° 50′ north and in longtitude 161° 53′ west. The island is about 10 miles in length, six in breadth, the eastern end rises about 20 feet above the level of the sea; the landing is on the west end and a vessel can lie in perfect safety in three fathoms of water.

The trees on the Island are coconuts, puhala, and a species of **Koa***. All kinds of vegetable will grow in the Island. I planted some beans, corn and water melons.

I erected a dwelling house on the Island and also a curing house for biche de mer. I left on the Island one white man and four Hawaiians who are engaged in curing the biche de mer.

I propose returning to the Island in about 10 days.

I have the honor to remain your obedient servant,

Z. Bent.

Honolulu, June 16, 1862."

The following proclamation was then issued by L. Kamehameha, Minister of the Interior, on June 18, 1862:

"Whereas on the 15th day of April 1862 Palmyra Island in latitude 5° 50′ north and longtitude 161° 53′ west, was taken possession of, with the usual formalities by Capt. Zenas Bent, he being duly authorized to do so, in the name of the Kamehameha IV. King of the Hawaiian Islands.

Therefore, this is to give notice that the said Island, so taken possession of is henceforth to be considered and respected as part of the Domain of the King of the Hawaiian Islands."

---

* **Kou** was evidently meant instead of **Koa.** There is indeed a tree very common on Palmyra which greatly resembles the **Kou (Cordia subcordata).** It belongs, however, to a different family altogether, and is **Pisonia grandis.** There is no tree on Palmyra which resembles the **Koa (Acacia Koa)** unless it be **Suriana maritima,** a shrub which has however entirely disappeared; it was recorded only by Streets from that Island.

In the year 1889, however, Palmyra was annexed to Great Britain by Commander Nichols of H. B. M. S. Cormorant which was cruising in the neighborhood of the Island. Commander Nichols, finding the place without any inhabitants, took possession in the name of Victoria, Queen of Great Britain and Ireland, Empress of India, Defender of the faith, etc. It did not remain long in the possession of Great Britain, if indeed it can be said ever to have been a part of the British Empire, for when the United States of America annexed the Hawaiian Islands, Palmyra was specifically mentioned in the President's message to Congress (Senate Dec. 16, 1898, 55th Congress, 3rd session, transmitting the report of the Hawaiian commission, in which the names of all the Islands (including Palmyra) are given.

Palmyra was once in the possession of the Pacific Navigation Company, who sent a man named Dillon in September, 1885, under contract for one year to Palmyra.

He agreed for that space of time to cut firewood, catch shark, fish, birds, etc., to plant coconuts, make a strong effort to find pearl shell, coral, etc. Dillon and his wife went to Palmyra, where they remained one year, returning to Honolulu the latter part of 1886 or early in 1887. Under date of October 25, 1886, Dillon reported coconut trees on the Island as follows:

Large trees in full bearing	2100
Small trees in full bearing	1000
Old trees not bearing	500
Young trees not bearing	6000

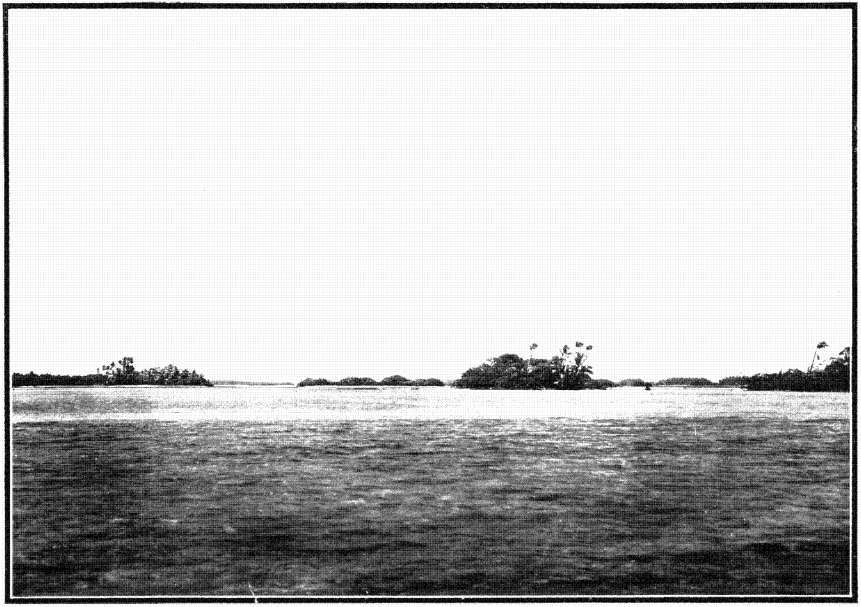
He stated that he had planted only 200 trees himself. The Island today is covered with at least 25,000 bearing coconut trees, which certainly cannot be the offspring of the 200 planted by Dillon who, moreover, stated that he planted them on one islet only.

The Island of Palmyra is now owned by the Hon. Henry E. Cooper of Honolulu, with whom the writer was priviledged to explore that wonderful atoll.

In the Land Court of the Territory of Hawaii is the following description of the above mentioned property:

"Palmyra Island north Pacific Ocean consists of a group of islets surrounded by a coral reef which extends about 5⅔ sea miles in an easterly and westerly direction and is about 1⅓ sea miles wide. The point of observation is about midway between the ends of the reef on the south side of the island and is north latitude 5° 49′ 04″ and west longitude 162° 11′ 29″."

DESCRIPTION OF PALMYRA ISLAND.



A view of some of the islets from the lagoon. The one to the extreme left is Cooper Islet.

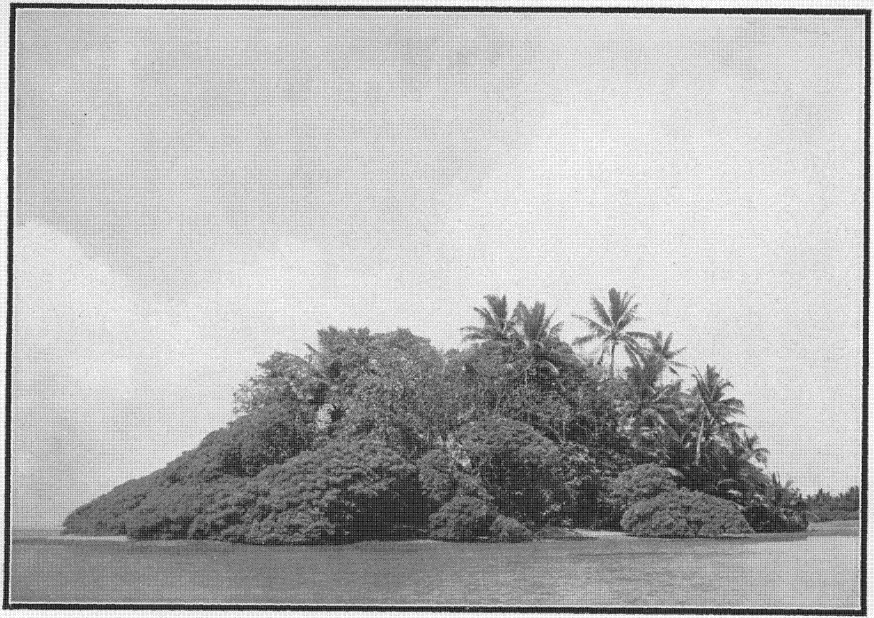
DESCRIPTION OF PALMYRA ISLAND.

On the invitation of the Hon. Henry E. Cooper, at that time President of the Board of Regents of the College of Hawaii, the owner of the Island of Palmyra, the writer accompanied him and Dr. C. M. Cooke, Jr., on a journey of exploration to Palmyra.

We started on the 3rd of July, 1913, in the power schooner "Luka", a vessel 70 feet in length, with a crew of seven including the captain. After an uneventful voyage, during which we met no vessel of any description, we sighted Palmyra on Friday afternoon, July 11th, at about 5 o'clock. Long before the Island was visible we saw flocks of birds flying in the direction where we knew Palmyra must be situated. Owing to the late hour of the day, our ignorance of the lay of the land, and the dangerous character of the reefs, it was impossible to effect a landing that night. "The Luka" lay to, and the next morning, Saturday, July 12th, we dropped anchor in 6 fathoms of water about 1½ miles from shore, off the western end of the Island.

The Island of Palmyra is a regular coral atoll and consists of approximately 52 islets, which enclose three large lagoons and one very small one; the deepest place is in the first (western) lagoon with 28 fathoms. In one of the lagoons are several small coral islets which are submerged at high tide, but exposed at low tide. The highest point is on Eastern Islet and does not exceed 5 feet. Palmyra atoll is approximately 5⅔ sea miles long, by 1⅓ sea miles wide. The largest islet comprises 46 acres, while the smallest covers only 0.47 of an acre.

Two charts were at our disposal: one, made in 1874, gave the following position (Observ. Spot), Lat. 5° 18′ 38″ North, Long. 162° 10′ 32″ West, mean rise and fall of tide 1 ft. 5 ins.; the other chart, made by H. B. M. S. Egeria in 1901, gave the position as Lat. 5° 52′ 18″ North, Long. 162° 5′ 55″ West. The southwestern portion of Palmyra presented to us a quite different aspect from what the first chart (1874) showed, but coincided with the second map. The northeastern portion also had changed, the larger islets indicated on the 1874 chart had divided into smaller ones, as shown on the Egeria chart of 1901. Several smaller islets had, however, been omitted on the latter map, and a few, especially *Holei Islet* incorrectly drawn.



A representative type of the islets forming the Palmyra atol. The taller trees are **Pisonia grandis** and **Cocos nucifera**, while the trees fringing the shores are **Tournefortia argentea**.

The chart in this bulletin (frontispiece) is based on these two older maps, corrected according to our findings.

On the western side Palmyra is bounded by an extensive flat coral reef, consisting of huge coral blocks or heads which rise to the surface of the water. This coral flat extends about 3 miles from the shore line, at which distance the depth of water is about 6-7 fathoms at high tide. The coral heads which issue from that depth nearly to the surface of the water are often 5 feet or more in diameter; they become more numerous near the shore, where the water becomes very shallow. It is at this place only that a landing can be effected, and that only at high tide; at any other time no boat can pass over this coral flat nearer than to within a mile of the shore.

A reef, over which the waves break continuously, extends the whole northern side of the island or group of islets, as well as along the whole length of the south and southeastern sides. On the latter side the breakers, which roar day and night, are only a few hundred feet from shore. The protection afforded by the land from the prevailing southeasterly and northeasterly winds makes it less dangerous for vessels to anchor at the western end, where, as already mentioned is located the only boat landing.

On the lagoon side, the islets are often surrounded by a narrow strip of perfectly white sand, which runs out into sand spits; at high tide this sand is covered with only about 10 inches of water, at low tide the depth of water is less than an inch, and in certain places the sand is exposed. It is on these flat sand spits, which reach the edge of the lagoon, that *Holothurians* abound in great numbers, mostly the black ones; the red ones are rather rare. In these warm shallow waters large balloon fish swim lazily about, blowing themselves up when touched and rolling about helplessly; this is also the home of the eel, of which there are several species. In the shallow bays where the bottom is muddy, thousands of mullets swim about, often jumping out of the water. Nothing is more interesting than to watch the marine life and fishes on the edge of the lagoons where the water is clear as crystal and where one can see the bottom several fathoms below. The most marvelously colored fishes abound. The shark is, however, not absent and frequents the narrow channels between the islets, which are usually waist deep. It is better to walk around these channels, especially at high tide, when walking from one islet to the other, rather than to cross them.

In very shallow water baby sharks abound, some 4 feet in length which are very annoying on exploring trips. Stepping on their heads, or when a number appear at one time, beating the water with the mid ribs of coconut palm leaves, suffices to frighten them away.

In the lagoons coral heads are to be found only on the western sides, the eastern sides merge gradually into white sand.

During our stay on Palmyra we established a rain guage, which registered as follows:

July	16	0.98 in.
"	17	0.45 "
"	18	0.38 "
"	19	0.03 "
"	20	0.47 "
"	21	1.35 "
"	22	0.41 "
"	23	0.08 "
"	24	0.00 "
"	25	0.00 "
"	26	0.21 "

The maximum temperature observed was 90° reached on two days, and the minimum of 78° occurred during the night.

Little was known regarding the vegetation of Palmyra. On one map one islet is marked as wooded, from which it is to be inferred that the rest of the islets are barren. However, a man who had visited the island years ago stated that all of them were wooded. On questioning the captain of the "Luka", who had visited the island once before, it was learned that there were plenty of trees and vines. The first view of the island was a surprise, for nearly all the islets, with the exception of the very small ones, are desenly wooded.

The first larger wooded island on which we landed, later named Home Islet, was decided on as the most suitable for pitching our tent since it received the benefit of the southeast trade winds. On Home Islet were signs of previous habitation. We found a wooden shack, covered with corrugated iron, full of wood and boxes with Japanese characters written on them; the place was surrounded by huge oriental jars 3½ feet high, a few broken, others in good condition and full of rain water. Behind the shack was a dug out pit

A portion of Paradise Islet, Palmyra. The coconut palms are in splendid condition; they have no enemies on Palmyra, save **Birgus latro,** the robber crab. The birds sitting in **Tournefortia argentea** are boobies, **Sula piscator**

which was undoubtedly used by the bird poachers in disposing of bird cadavers.

From Home Islet as headquarters we explored the various islets and lagoons. The salient features of the larger islets are detailed below:

HOME ISLET.

Home Islet, on which our camp was located, lies at the south-western end of the atoll near the landing place. On it is located the Observation spot indicated on the map. The ground is composed of loose coral fragments, sand, and guano phosphate. The loose coral fragments predominate, only on the eastern and lagoon side is there a strip of perfectly white floury sand. There seems to be no soil whatever nor any presence of humus.

Nearest to the water line the islet, as are all the rest of them, is fringed by beautiful and rather large *Tournefortia argentea* trees, (a giant Heliotrope), and in the interior a few almost deciduous trees of *Pisonia grandis,* with leaves resembling *Cordia subcordata,* (the Hawaiian *Kou*) abound, with coconut trees 50 to 60 feet tall. The undergrowth is formed of huge *Asplenium nidus* (Birds' nest) ferns. This is the typical undergrowth of most of the islets, and so tall are the fronds that it is impossible to gain a lookout; one is completely hidden and progress is only possible by throwing ones self backward into the mass of fern, emerging finally covered from head to foot with the fine brown spores of this fern.

The Tournefortia trees are large, 30-40 feet in height, and lean right over the water, their leaves touching its surface at high tide. The center of the islet is a dense jungle of birdsnest ferns and *Fleurya ruderalis,* an herbaceous plant belonging to the nettle family (*Urticaceae*) which reaches a height of 3 feet. It occurs in great numbers and can be found on all the islets. On exploring the islet we were greeted by a multitude of hermit crabs (*Coenobita olivieri* Owen) dragging after them the heavy shell of *Turbo argyrostoma,* which they prefer to the exclusion of all others. They are red in color while a few other species less numerous are of a pale purple and other colors. A most annoying creature indeed is the hermit crab. They climb the trees and feed on the flowers of the Tournefortias, and at the same time are cannibals, two or three crabs attacking a fellow crab and tearing him out of his shell to be devoured. They attacked our bags of rice and other victuals.

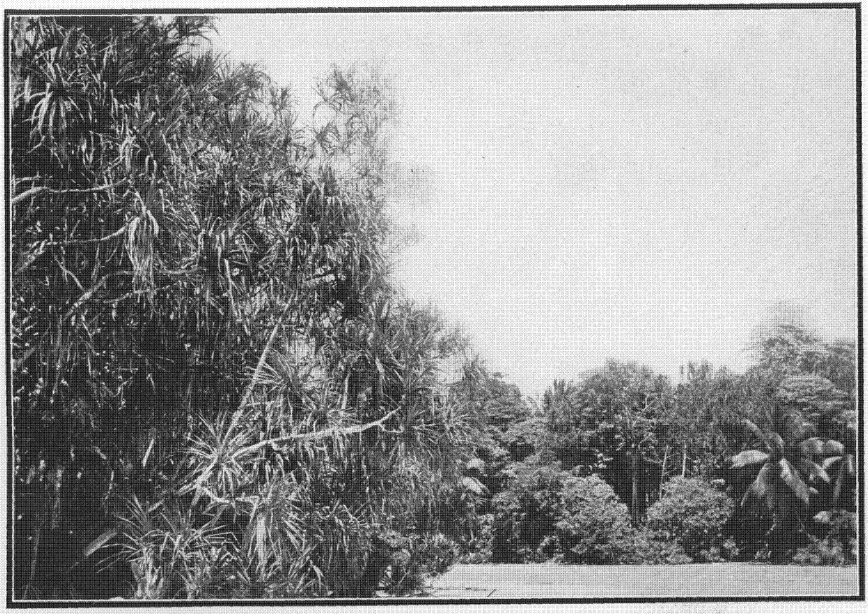
Interior of Paradise Islet. Note Coconut palms in all stages of growth. In the right hand corner **Aspienium nidus.**

the contents of which we found on the ground after our first night on shore. On penetrating farther inland we found the much talked of coconut crab (*Birgus latro*) which abounds in great numbers. They are quite harmless, unless one should deliberately stick one's finger into their claws. We saw some of enormous size, especially on *Holei Islet.* They are a delicacy much better than any lobster. While in pursuit of our luncheons we opened a few coconuts for milk and food and leaving them on the beach (lagoon side) on the white sand near the undisturbed shallow water, these nuts acted as bait for the crabs. Indeed huge ones emerged from the forest attracted by the coconuts, which they must have smelled. After we had killed a couple for food, we found out that *Birgus latro* is not only a vegetarian but has acquired a taste for his brother crab.

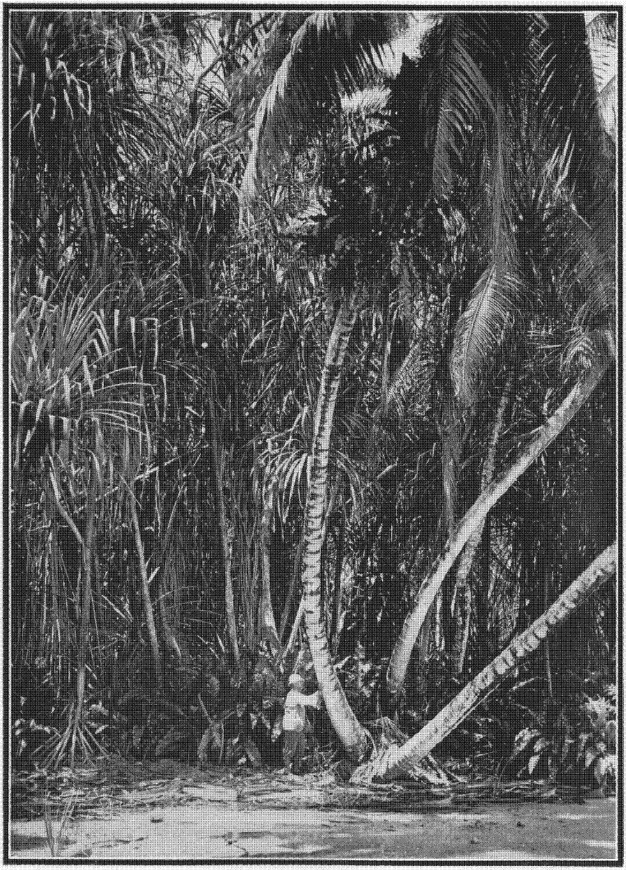
In the interior of some of the islets where the undergrowth is not so dense, the ground is undermined and when walking along one is likely to sink a foot or more into the ground. These passages, which have large openings, are made by a big land crab a foot or so in diameter. It is a species of *Cardisoma* and may be identical with *C. obesum,* collected by Streets in the Fanning group.

A very interesting feature was the many birds which inhabit these beautiful islets. The large blue billed Booby (*Sula piscator*) roosted on the branches of *Tournefortia argentea* on the lagoon side; they are extremely tame, as are all the other species of birds inhabiting Palmyra. Boobies which had no young, flew from their nests on approach, while those with young remained setting. On teasing them they become rather nervous and more than one gave up its last meal; in one case consisting of five large undigested flying fish. The interior of Home Islet, like the rest of the islets, is inhabited by a beautiful white bird a little smaller than a pigeon, commonly known as lovebird (*Gygis alba*). They are perfectly white, with black bill and black eyes. This bird, which seemed to be the most curious of all, as it hovered continuously over one's face, builds no nest and lays only one egg and that on the bare naked branches, some of which we found not to be thicker than an inch and a half. It is marvelous how this bird can balance its egg so that it does not fall off. As they are laid on branches of trees in the dense interior, they are protected from wind.

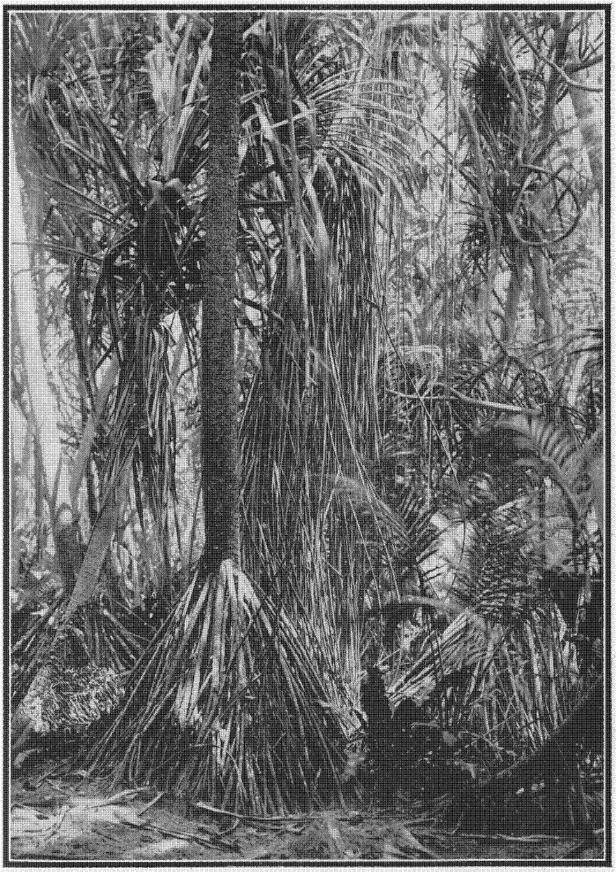
Boobies, besides the very common *Sula piscator,* can be found, but not at all numerous. One *Sula sula,* is of a brown color with



Bay on Holei Islet, Palmyra. The main plants are **Pandanus Rockii, Cocos nucifera, Pisonia grandis** and **Tournefortia argentea.**



Dense jungle on Holei Islet, Palmyra. **Asplenium nidus** forms the undergrowth. The main plants are **Pandanus**, **Ochrosia**, and **Cocos nucifera**. Note **Asplenium nidus** on coconut trunks.



Pandanus Rockii Martelli. Dense growth of Pandanus on eastern end of Holei Islet, Palmyra. The aerial roots of old trees are very slender and form impenetrable masses.

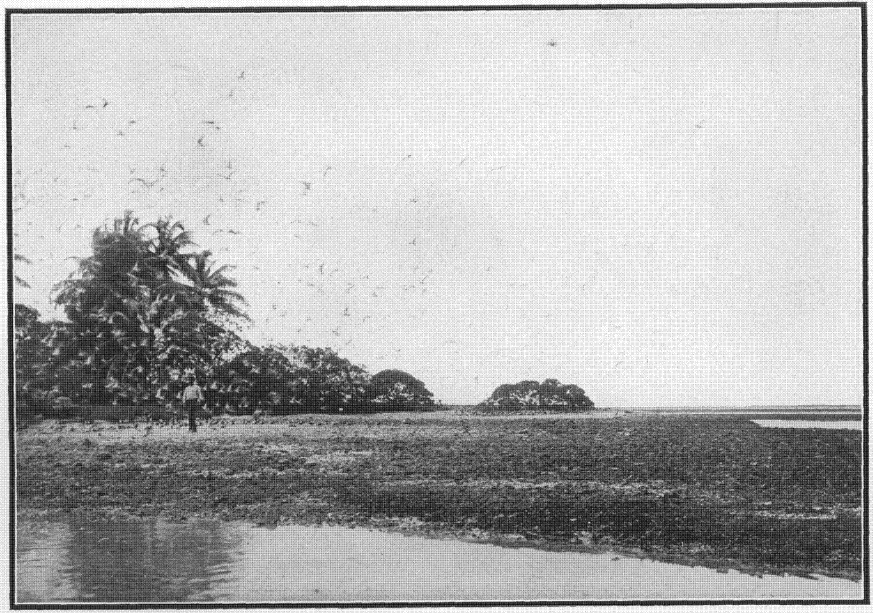
black bill; it roosts in company with *Sula piscator* in Tournefortia branches and lays one egg, while the other species, *Sula cyanops,* rather rare, has black and white plumage, makes no nest and lays usually two eggs in the bare sand, commonly in the vicinity of *Monerma repens,* the only species of grass on Palmyra. The man-of-war or frigate bird (*Fregata aquila* L.) we found nesting on the tree tops, and watching for the return of the boobies, eager to rob them of their food. The Plover, the *Wandering Tatler* (*Heteractitis incanus*) and the Curlew (*Numenius tahitiensis*) can also be met with on the shores of Palmyra. There is an entire absence of mosquitoes of any kind. There are only two species of flies and these are not very common. They belong to the *Ortalidae* genus *Pterocallinae,* one of which is known from Honolulu, where it breeds in the albumen of the coconut. A species of ant (*Tetramorium guinense* Fab.) is very abundant but not a nuisance. This ant appears to feed on small inscets which live on the fronds of the bird's-nest ferns. Spiders are abundant, a few species spinning webs between branches and ferns; one large species sits on the broad leaves of bird's-nest ferns watching for its prey. Crickets and crustaceae as well as earwigs abound, the latter under the bark of Tournefortia trees. Minute little flies sit on the beach sand and others fly about in the interior. One deserves special mention, it is of a brilliant green and has rather long legs, and was identified by the entomologists of Honolulu as *Gnampsopsilopus patellifer.*

HOLEI ISLET.

Holei Islet is one of the prettiest of the whole group and is probably the next largest in size to Cooper Islet, on the opposite side of the lagoon.

It is on this islet that *Ochrosia oppositifolia* is found, and on this account we named it Holei Islet from the Hawaiian name *Holei,* given by the Hawaiians to another species of *Ochrosia* (*O. sandwicensis*), peculiar to the Hawaiian Islands.

On Palmyra the former species, which, however, is widely distributed over the islands of the South Pacific, occurs only on this islet and there only on its western end. The trees here grow in company with huge *Pisonia grandis* trees. The Ochrosia trees branch at long internodes and in whorls, each single branch again branching likewise. The bark is yellowish, rather thin, and covered with lenticels, the foliage is large, dark green, and resembles



Bird Islet, Palmyra. It is the breeding ground of the most common tern, **Sterna fuliginosa.**

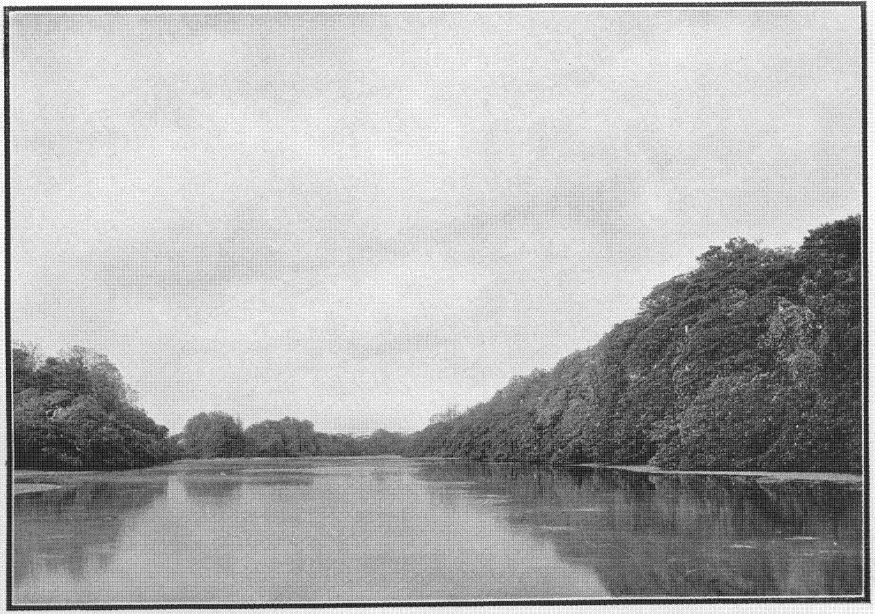
the native Hawaiian Kamani (*Calophyllum inophyllum*). On this western end of the islet the ground is composed of huge solid blocks of phosphate rock, with a layer of black humus two inches thick. According to the charts it was on this end of Holei Islet that a fresh-water pond was situated. We found, however, no traces of a pond, save a somewhat muddy circular depression which was overgrown with coconuts, ferns and Pandanus. At about the center of the islet (see plate V) is a beautiful bay fringed by coconut trees, Pandanus and large Pisonias, while the trunks of all of these are covered with bird's-nest and Polypodium ferns. At low tide the whole beach is extremely soft and muddy, the foot sinking into the mud at every step. Many coconut trees had fallen to the ground and were still growing in this prostrate condition. It was in this bay that we observed the only specimen of pig-weed (*Portulaca oleracea*). The eastern end of this islet is mainly covered by a Pandanus forest, the species being *Pandanus Rockii* Martelli, new to science (see plate VII).

BIRD ISLET.

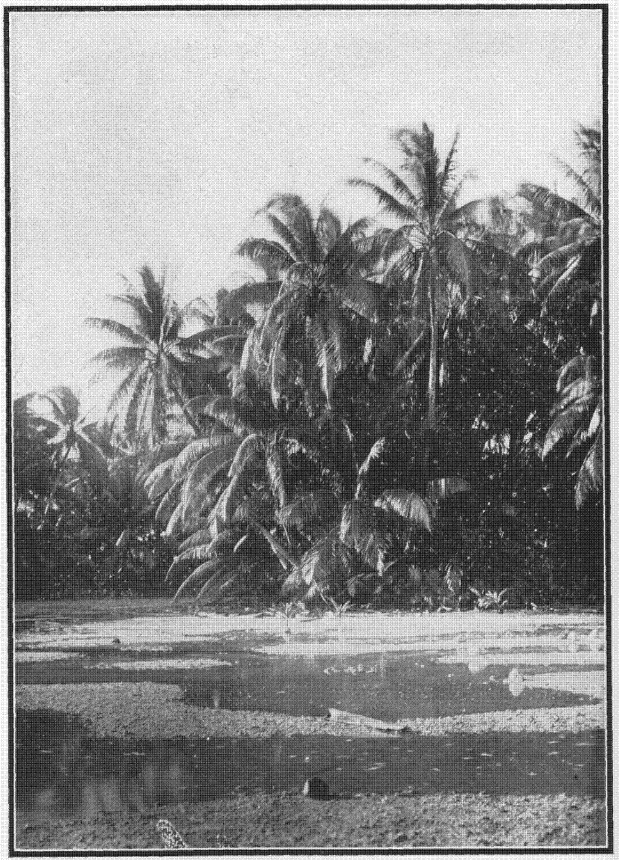
South and opposite Holei Islet are a few small islets with large coral-clinker flats. These are known collectively as Bird Islet (see plate VIII). Only a very small portion is covered with vegetation, the rest being bare coral fragments, the breeding ground of *Sterna fuliginosa,* the sooty tern. It lays only one brownish speckled egg in the bare coral or sand without building a nest. This is by far the most numerous bird on Palmyra. Another tern, *Anous stolidus,* noddy tern) of black color with white occipital, roosts on branches of *Tournefortia argentea.*

EASTERN ISLET.

The eastern-most islet, which we named Eastern Islet (see plate IX), is rather long and very narrow. It is different from the other islets in its composition and is also propably the highest, about 5 feet above sea level. Coconuts are absent; the main tree is *Pisonia grandis,* which reaches a very large size, a few specimens of Pandanus growing with them and a few Tournefortia trees on the south side of the islet facing the ocean. The ground is covered with stunted specimens of *Polypodium phaematodes; Ipomoea glaberrima* becomes a huge liana, its stems being twisted and about

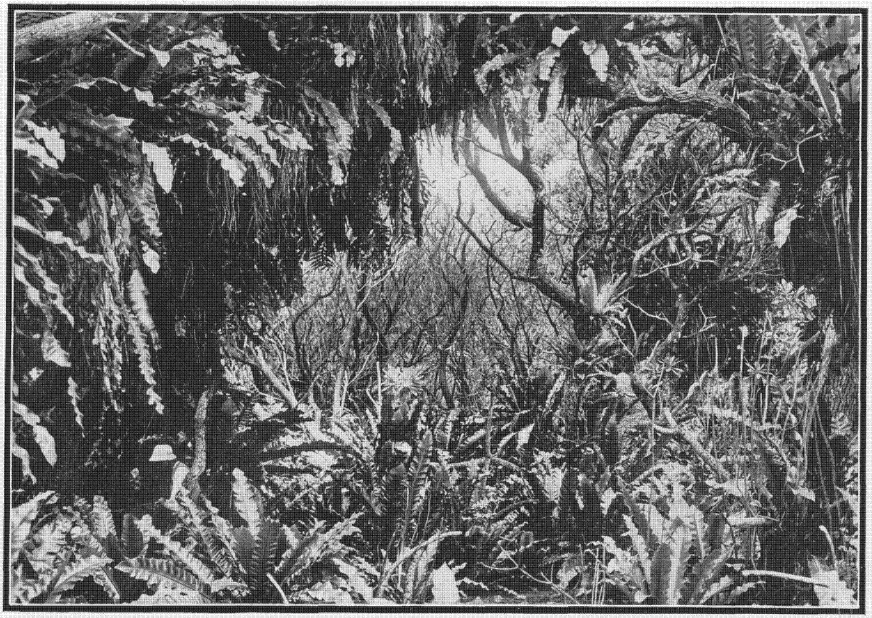


A bay on Eastern Islet, Palmyra. There are no coconut trees on this islet. **Pisonia grandis** is the sole occupant save a few scattered trees of Pandanus. The water in this bay is only about 4 inches deep. The white spots in the foliage are birds **(Sula piscator)**.



Eastern end of Cooper Islet. The sole vegetation consists of fine Coconut palms. Note the nuts scattered over the coral sands; some of them have already germinated. This picture was taken at low tide.

On the windward side of Cooper islet, Palmyra. The large leaved plants are **Tournefortia argentea, Asplenium nidus** covers the ground and trees, while **Polypodium phymatodes** hangs gracefully from the ends of branches. This is on the water's edge.



A jungle of Birds' nest ferns (**Asplenium nidus**) on Cooper Islet, Palmyra. The trees in the background are **Tournefortia argentea**.

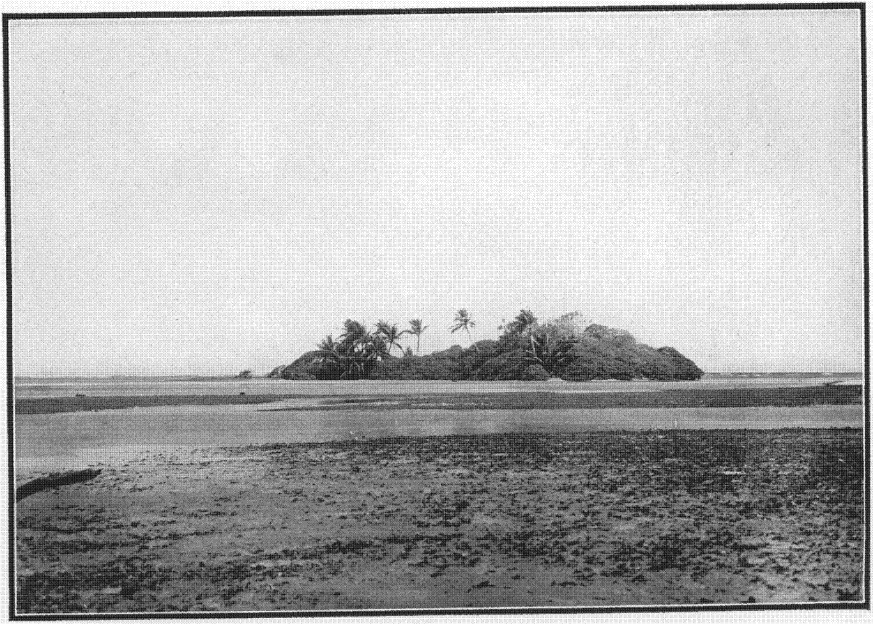
Coral flat on the shore of Cooper Islet, Palmyra; the grass in the foreground is **Monerma repens**, the trees are **Tournefortia argentea** and **Cocos nucifera**.. Note the erect habit of **Monerma repens.**

an inch in diameter. Plate IX shows a little bay on that islet with its peculiar vegetation.

COOPER ISLET.

Plates X, XI, XII and XIII.

The largest islet and one of the most beautiful of the Palmyra group is Cooper Islet, which we named after our host, the owner of Palmyra, Hon. Henry E. Cooper. Cooper Islet is practically divided into two islets, once undoubtedly separate. The eastern and western portions of this beautiful islet are densely wooded, while the middle portion is composed of loose coral clinkers, without trees and only sparingly covered with a growth of *Boerhaavia tetrandra,* a creeper with thick root stock, and *Lepidium owaihiense,* a low and bushy plant of the *Cruciferae,* first collected in, and a native of, Hawaii, but since found also on the islets west of Hawaii, between the latter and Japan. *Fleurya ruderalis* grows also on these coral clinkers, but stunted, and with it, but more towards the lagoon side where the coral is mixed with white sand, grows the only grass on Palmyra, *Monerma repens.* Ferns encroach on this coral flat but remain stunted. On the border, the trees are covered with *Ipomoea glaberrima,* a morning glory which appears to be very destructive, killing off and checking the growth of its supporter. *Cocos nucifera* forms beautiful stands, with the falling nuts covering the ground several feet thick, and germinating everywhere. Thousands of coconuts had germinated in the actual salt water, on the edge of the lagoon, where they are being washed about by the tide. The sandy spits all along the lagoon side of this islet are covered with germinated coconuts in all stages of growth, till one reaches the dense and somber shade of the enormous groves of this magnificent palm. Here they appear to have no insect enemies whatever, the fronds are perfect and not ragged as in Honolulu, where they are attacked by the coconut-leaf roller moth. The nuts of the Palmyra coconut are the finest and the biggest the writer has ever seen, which testimony is also given by the eminent authority, Dr. O. Beccari of Florence, Italy.



Strawn's Islet, the northwestern most on Palmyra. Its vegetation consists mainly of **Pisonia grandis, Cocos nucifera, Tournefortia** and **Pandanus.**

FLORA OF PALMYRA.

The plant covering of Palmyra at the time of this exploration consisted of the 38 species hereafter described, of which 12 are algae, 3 fungi, 7 lichens, 1 moss, 2 ferns, and 13 flowering plants. There are doubtless a few more species of fungi and the lower forms of algae. Of the Cryptogams, 1 alga, 2 fungi, and 3 lichens are new to science and described herein for the first time. One new species and one new variety of Pandanus are described, and the coconut palm is reported by O. Beccari as a new form.

The scarcity of marine algae was greatly surprising; brown algae were entirely absent, not a single *Sargassum* could be found anywhere. *Cladophora sabulosa,* a green alga (described as new in this paper by Dr. H. L. Lyon), is the only conspicuous alga on Palmyra. It resembles a small round ball filled with sand, and rolls about loose in shallow water. The two species of *Halimeda* enumerated herein grow on the edge of the lagoon between coral, while the two species of *Caulerpa* grow in the sand, usually in the channels between the islets. There are undoubtedly a great many diatoms and other miscroscopic algae, but they are not embodied in this report.

Only a few fungi were found. Several toadstools, together with a species of *Hirneola,* which were collected, were unfortunately lost.

A number of botanists have collaborated in the identification of the plants collected on this expedition to Palmyra. In the following pages the descriptions of species are to be credited to the authors whose names appear under the headings of the various groups. The remaining species were identified and enumerated by the author of this bulletin. The photographs reproduced in this bulletin, with the exception of plates XV, XVI, and XVII, XVIII, were taken by the author; the four plates mentioned were taken by U. Martelli and O. Beccari respectively.

ALGAE

By Marshall A. Howe and Harold L. Lyon.

1. **Lyngbya gracilis** (Menegh.) Rabenh. Fl. Eur. Algar. 2:145. 1865 Filaments 5 to 7 μ in diameter; trichomes slightly constricted at cross-walls; cell contents rose colored when viewed by transmitted light. Growing on sand in carpet-like masses which are dark, reddish purple in color. (Determined by Lyon.)

2. **Lyngbya confervoides** C. Ag. forma **violacea** Collins. The Algae of Jamaica. Proc. Amer. Acad. Arts. Sci. 37:240. 1901. Filaments 23 μ in diameter; trichomes 19 μ in diameter; cells 5 to 8 μ long; contents of cells bright violet. Plants in mass rose-colored, forming a skin-like covering on coral. (Determined by Lyon.)

3. **Enteromorpha plumosa** Kutz. Phycologia generalis p. 300, t. 20, f. 1. 1843. A form, smaller and less branched than the Adriatic type of the species, but seems scarcely to differ otherwise. The species has been reported, with some doubt, from the Hawaiian Islands (J. Ag. Till. Alg. Syst. 3:151. 1882). (Determined by Howe.)

4. **Cladophora sabulosa** Lyon n. sp. Plants adhering together in compact, spherical colonies which catch and hold loose particles of sand, thus forming soft sand balls, 2 to 3 inches in diameter, which roll about freely in shallow water.

Plant body consisting of long, infrequently branched filaments which meander through the sand, and closely branched filaments of the typical Cladophora type which constitute the peripheral portion of the colonly and extend free beyond the sand. Filaments within the sand-ball infrequently divided, usually branching as in the genus Cladophoropsis of Borgesen. Cells in outer, vegetative portion of filaments varying from 100 to 180 μ in width but usually 125 to 130 μ wide and three to five times as long, frequently producing haptera, either directly at their apices if they are in contact with another filament or at the ends of slender, segmented, rhizoid-like filaments which may be produced to considerable lengths. These haptera tie the filaments together throughout the periphery of the colony thus forming a network in which loose particles of sand lodge.

5. **Caulerpa Freycinetii** Ag. var. **typica** forma **lata** Weber van Bosse. Monographie des Caulerpes. Anns. due Jard. Bot. de Buitenzorg 15:313. Pl. XXV, f. 5. 1898. (Determined by Lyon.)

6. **Caulerpa cupressoides** (Vahl.) Ag. var. **typica** Weber van Bosse. Monographie des Caulerpes. Anns. du Jard. Bot. de Buitenzorg 15:327. Pl. XXVII, f. 1-3. Pl. XXVIII f. 1. 1898. (Determined by Lyon.)

7. **Halimeda Opuntia** (L.) Lamour. Corall. flex. p. 308; Expos. meth. p. 27 t. 20, f. 1. More elongate and slender and the segments smaller and less lobed than in the typical form. (Determined by Howe.)

8. **Halimeda macroloba** Decaisne. Corall. p. 91; Arch. du Museum

2:118. Segments smaller than usual. The species has its best development in the Indian Ocean. (Determined by Howe.)

9. **Dictyosphaeria favulosa** (Ag.) Decaisne Class. des Algues, p. 32. 1842. (Determined by Lyon.)

10. **Lithopyllum craspedium** Fosl. forma **abbreviatum** Fosl. Calc. Algae from Funafuti, p. 7. 1900. This species has a reputation as a reef-builder in the Pacific and Indian oceans. It was first described from Onotoa, in the Gilbert Islands, and Funafuti, in the Ellice Islands. (Determined by Howe.)

11. **Lithophyllum Kaiserii** Heyd. var. ? Lithothamnion Kaiserii Heyd. Corall. insbes. Melob. p. 64. t. III, f. 8, 12, 13. 1897. Approaching in habit L. Gardineri Fosl. forma subhemisphaericum Fosl. (Determined by Howe.)

12. **Goniolithon frutescens** Fosl. Calc. Algae from Funafuti, p. 9. 1900. (Determined by Howe.)

FUNGI

By H. L. Lyon.

1. **Auricularia adnata** Lyon n. sp. Fruit-bodies plaster-like, oval or oblong, 3-6 cm broad and up to 18 cm long. Pileus adhering to the substratum throughout most of its extent but having a few narrow free lobes along its margin which are covered with short, tufted, grey and rusty brown hairs. Hymenium grey to lead colored; ridges low, much branched and intersecting to form small meshes. Spores not seen.

On **Tournefortia** trees.

2. **Polystictus Palmyrensis** Lyon. n. sp. Fruit-bodies pendant, broadly subconical, 2 to 25 mm in diam., gregarious, coalescing at their margins to form irregular, composite fructifications which may be 8 to 10 cm long by 3 to 6 cm broad, with a continuous but pitted hymenium and a roughened pileus with many crater-like points which are the points of attachment of the various units. Pileus of each unit attached near its center, distinctly marked with concentric ridges, straw-colored to light ochre-yellow. Hymenium more or less concave, with or without a distinct pit beneath the point of attachment, white to straw-colored; context fibrous straw-colored; pores round, 100 to 150 μ in diam., varying in length from shallow pits at the margin to tubes 2 mm long in the center of the fructification with walls well supplied with prominent, granule-coated spines, 6-8 μ wide and 16-26 μ long, which are strongly inclined downward. Spores not seen.

The presence of spines in the pore walls would indicate that this fungus might be referred to the genus Mucronoporus E. & E., while in shape and structure it agrees with Murrill's Coltriciella.

On **Tournefortia** trees.

3. **Melanconium Pandani** Lev. Champ. exotiques Ann. Sci. Nat. Bot. 1845, p. 66. On fruits of Pandanus.

LICHENES

Auctore Dr. A. Zahlbruckner.

PYRENULACEAE.

Anthracothecium libricolum Mull. Arg. in Linnaea, vol. XLIII, 1880, p. 43 et Pyrenocarp. Feéan. in Mémoir. Soc. Phys. et Hist. Natur. Geneve, vol. XXX, No. 3, 1888, p. 23; A. Zahlbr. in Sitzungsber. Kais. Akad. Wissensch. Wien. math.-naturw. Classe. vol. CXI, Abt. 1, 1902, p. 368. **Pyrenula (Phrenastrum) libricola** Fee, Essai Cryptog. Ecorc. Offic., Supplem., 1837, p. 82, tab. XLI, Pyrenula fig. 31. **Verrucaria libricola** Nyl. in Bull. Soc. Linn. Normand., ser. 2a., vol. II, 1868, p. 126.

Thallus epiphloeodes, 0.1-0.14 mm crassus, subchondroideus, KHO e flavo plus minus sanguineus; stratum corticole decolor, ex hyphis tenuissimis, longitudinalibus et conglutinatis formatum, 27-36 μ crassum; stratum gonidiale angustum, ex hyphis tenuibus laxioribus et gonidiis chroolepoideis formatum, gonidiis passim intra elementa substrati penetrantibus. Excipulum integrum, fuligineum, primum subglobosum, demum plus minus tranvese late ellipsoideum, ad basim tenuius 24-30 μ crassum, in parte superiore circa ostiolum latius 50-60 μ srassum, lateraliter thallino-vestitum, cum parte inferiore in substrato immersum.

Corticola.

CYPHELIACEAE.

Cyphelium ignobile A. Zahlbr., nov. spec. Thallus crustaceus, uniformis, epiphloeodes, crassiusculus, usque 1 mm altum, farinulento-amylaceus, friabilis, plagas minores, usque 4 cm latas, dispersas vel passim confluentes formans, subochraceo-cinerascens, fuscescenti-cinerascens, rarius sublilacino-cinereus, opacus, KHO-, Ca Cl_2 O_2-, areolato-diffractus, fissuris, altis, latiusculis et hiantibus, sorediis et isidiis destitutus, versus marginem sensim vel fere abrupte angustatus, linea distincta obscurisve non limitatus; stratum corticale 17-30 μ crassum, dilute lutescens, ex hyphis dense intricatis, tenuibus formatum, pulverulento-inspersum; gonidia palmellacea, globosa vel sulglobosa, laete viridia, 3-4 μ lata, membrana tenui cincta, glomerata glomerulis fasciculis hyphorum congluti tinatorum perpendicularibus angustis interruptis, stratum crassiusculum formantia; medulla alba, crassa, I-, ex hyphis dense intricatis et inspersis formata.

Apothecia in areolis thalli ut plurimum solitaria, verrucae apothecii gerae planiusculae vel concavae, primum disco thallum aequantia, demum cum paulum superantia, rotunda vel rotundata, 0.5-0.8 (1) mm lata, margine proprio distincta, angusto, albido, integro, acutiusculo, discum vix superante cincta, margine thallino distincto destituto, discus fusconigricans, madafactus in fuscum vergens, planum

epruinosum; excipulum integrum, angustum, pallidus, dilute lutescens, ex hyphis tangentialibus, tenuibus et dense conglutinatis formatum; hypothecium sat pallidum, sordide fuscescens; hymenium in sectione transversali primum angustum, fere oblongum, demum dilatatum; mazaedium fusconigrum, jam in apotheciis valde juvenilibus evolutum; ascus et paraphyses in speciminibus visis frustra quaesivi; sporae ex hyalino mox fuscae, late ellipsoideae vel subrhomboideae, apicibus retuso-rotundatis, hinc inde subpapillatis, uniseptatae, cellulis aequalibus vel parum inaequalibus, guttula oleosa unica impletis, ad septum plus minus constrictae, septo passim parum oblique, 8.5-11 μ longae et 5.5-8 μ latae.

Pycnoconidia non visa.

Corticola.

A caeteris speciebus generis differt apotheciis in areolis thalli immersis et eas vix superantibus et deficiente margine thallino apotheciorum crasso. Dein pecliarris est areolatio thalli. Etiam sporis minutis congeneribus distat.

GRAPHIDACEAE.

Opegrapha Bonplandi Fee, Essai Cryptog. Ecorc. Offic., 1824, p. 25, tab. V, fig. 4, et Supplem., 1837, p.19, tab. 39, fig. 4 (exclus. syn.); Muller Arg. in Mémoir. Soc. Phys. et Hist. Natur. Geneve. Vol. XXIX, No. 8, 1887, p. 17; Shirl. in Proceed. Roy. Soc. Queensland, Vol. VI, 1889, p. 197. **Opegrapha Bonplandiae** Nyl. in Annal. Scienc. Natur., Botan., ser. 4a., Vol. XI. 1859, p. 229 et Vol. XIX, 1863, p 375, ser. 5a., Vol. VII, 1867, p. 336. in Acta Soc. Scienc. Femic. Vol. VII, 1863, p. 475, in Flora, Vol. XLIX, 1886, p. 293 et Vol. LII, 1869, p. 71 et in Bullet. Soc. Linn. Normandie. ser. 2a., Vol. II. 1868, p. 95: Hue in Nouv. Archiv. du Museum, ser. 3a., Vol. III. 1891. p. 171; Harm. in Bullet. Soc. Scienc. Nancy, ser. 3a., Vol. XIII, 1912. p. 59.

Thallus crustaceus, uniformis, epiphloeodes, tenuis, 0.07-0.09 mm altus, maculas rotundatas formans vel effusus, glaucescenti-vel cinerascenti-albidus, rarius virescens vel subflavescens vel (secundum Fee) cum actate fusco-aeneus, opacus, KHO-, Ca Cl_2 O_2-, continuus, laevigatus. sorediis et isidiis destitutus, in margine nonnihil obscure limitatus; stratum corticale decolor. ex hyphis valde tenuibus et intricatis formatum 18-24 μ crassum; gonidia inferiorem partem thalli occupantia. chrolepoidea, cellulis subglobosis, 8-12 μ longis, concatenatis, catenis plus minus involutis.

Apothecia sessilia, plus minus approximata, nigra, opaca, linearia, lirellae subrectae vel curvatae, simplices, bi-vel trifurcatae. usque 3 mm longae, tenuies, 0.1-0.15 mm latae et fere totidem altae, in margine a thallo liberae; discus rimiformis vel passim parum dilatatus et planiusculus. niger, opacus. epruinosus; excipulus fuligineum, integrum, crassum, lobiis superne involutis. ad basin truncatis non sulcatis: epithecium distinctum nullum; hymenius decolor. dense granulato-inspersum, I sanguinea-cupreum; hypothecium angustum,

decolor; paraphyses tenuis, filiformes, sat dense ramosae, eseptatae; asci oblongo-clavati, ad apicem rotundati et ibidem membrana leviter incrassata cincti, facile secedentes 60-64 μ longi et 16-19 μ lati, 8 spori; sporae in ascis 3-4 seriales, verticales, decolores, fusiformi-oblongae, utrinque angustato-rotundatae, membrana fere crassiuscula (ad 1.5 μ lata), cinctae, 9-10 loculares (loculis disciformibus), 33-37—(46) μ longae et 4.5-7.5—(8) μ latae, I-vel lutescentes.

Corticola.

Graphis (sect. **Eugraphis**) **palmyrensis** A. Zahlbr., nov. spec.

Thallus crustaceus, uniformis, epiphloeodes, tenuis, 0.08-0.12 mm crassus (circa apothecia altius, usque 0.2 mm crassus), late effusus, lacteus, opacus (passim fortuito rubens), KHO-, Ca Cl_2 O_2-, continuus et submembranaceus vel rarius irregulariter et tenuiter rimulosus, sorediis et isidiis destitutus, superne strato corticali, decolor, 17-28 μ alto, ex hyphis tenuibus et intricatis formato et etiam in rimis descedente obductus; gonidia chroolepioidea, crebra, stratum crassum formantia, cellulis late oblongis ovalibus vel subirregularibus, concatenatis, hyphae medullae valde tenuies, non amylaceae.

Apothecia numerosa, dispersa vel approximata, sessilia, primum crassiuscule, in speciminibus adultis angustino thallino-vestita, linearia, 0.5-4 mm longa et 0.2-0.5 mm lata, ut plurimum simplicia, recta, subrecta, curvata vel hamata, rarius furcata vel triloba, utrinque acutata vel rotundata, nigra; discus angustus rimaeformis, niger, epruinosus, et a labiis excipuli angustis, a margine thallino-passim leviter secedentibus parum separatus; excipulum duplex, externum fuligineum, dimidiatum, lobis inferne plus minus truncatis, superne acutatis vel rotundatis, inflexis, non sulcatis, internum lutescens infra hymenium bene evolutum, sed angustum, lateraliter in excipulum externum aberens epithecium distinctum nullum; hymenium in sectione transversali subcordatum vel transverse suboblongum, superne fusco-nigricans, caeterum decolor, granulis minutis densisque impletum, 120-180 μ altum, I-; hypothecium angustum, decolor, ex hyphis dense intricatis formatum, minus pellucidum ut excipulum internum; paraphyses parum distinctae, simplices, eseptatae, ad apicem non latiores, conglutinatae; asci oblongo-vel ellipsoideo-clavati, 8 spori; sporae decolores, digitiformi-oblongae, utrinque rotundatae, rectae vel subrectae (8)-10 loculares, loculis late lentiformibus, I violascentes, 26-35 μ longae et 7.5-8 μ latae.

Pycnoconidia non visa.

E sectione **Eugraphidis** apotheciis sessilibus, plus minus thallino-vestitis, hymenio bene insperso, sporis 10 locularibus et labiis excipuli externi inferne truncatis distincta species.

LECIDEACEAE.

Bacidia medialis A. Zahlbr. in Denkschrift. math. naturw. Class. K. Akad. Wissensch. Wien. Vol. LXXXIII, 1909, p. 127. **Lecidea medialis** Tuck. apud Nyl. in Annal. Scienc. Nat., Bot., ser. 4a., Vol.

XIX, 1863, p. 46. **Biatora medialis** Tuck., Synops. N. Amer. Lich., Vol. II, 1888, p. 132. **Patellaria (Bacidia) medialis** Muell. Arg. in Flora, Vol. LXVII, 1884, p. 467.

Thallus epihloeodes, crustaceus, uniformis, tenuis, cinerascens vel glaucescens, opacus, KHO-, Ca Cl_2 O_2-, verrucculoso-inaequalis vel rugulosus, sorediis et isidiis destitutus, in margine non bene limitatus nec linea obscura cinctus.

Apothecia biatorina, adpresso-sessilia, dispersa vel approximata, rotunde, parva, 0.2-1 (1.2) mm lata, e plano demum leviter convexa, testacea, luteo-rubella vel rufescentia, fere opaca, epruinosa; margo proprius tenuis, integer, acutiusculus et vix prominulus, demum plus minus depressus, disco concolor vel paulum obscurior vel pallidior; excipulum ex hyphis radiantibus, conglutinatis et septatis formatum, subchondroideum, in margine rufescens, intue pallidum, gonidia non includens; epithecium distinctum non evolutum; hypothecium pallidum, ex hyphis dense intricatis formatum; paraphyses capillares, conglutinatae, simplices, eseptatae, non clavatae; hymenium decolor, guttulis oleosis non impletum, 52-56 (80) μ altum, I e coeruleo vinose rubens; sporae colores, cylindrico-fusiformes vel subbacillares, rectis vel curvalis, 4 locularibus, 18-23 (36) μ longae et 2-3 (4) μ latae.

Corticola.

PHYSCIACEAE.

Pyxine oceanica A. Zahlbr. nov. spec.

Thallus foliaceus, substrato arcte affixus, radiatim crescens, plagas usque 11 cm latas formans, glaucescenti-albidus, opacus, KHO-, Ca Cl_2 O_2-, pruinosus, tenuis, 0.13-0.15 mm crassus, laciniis marginalibus linearibus, 2-3 mm latis et 1-2 mm longioris, subplanis, ad apicem inciso-crenatis, caeterum plum minus confluentibus, pauciramosis, convexis, versus centrum soralibus pulverulentis-griseis, confluentibus, plerumque obsitis, subtus fusco-niger, opacus, rhizinis increbris et brevibus, nigris, versus ambitum thalli pallidioribus munitus; cortex superior tenuis, 25-36 μ altum, ex hyphis tenuibus, valde inspersis, fere perpendicularibus et septatis formatus, maculas parves offerens; cortex inferior nigrescens, tenuis, 17-26, μ crassum, ex hyphis longitudinalibus, 0.16-1.8 μ crassis, dense contextis formatus; medulla alba, KHO-, Ca Cl_2 O_2-, hyphis medullaribus ad 1.5 μ crassis, lepto dermaticis; rhizinae crassae, 80-110 μ latae, breves, ex hyphis longitudinalibus et conglutinatis formatae.

Apothecia sessilia, lecideina, nigra, parva, 0.7-1.2 mm latae, e concavo subplana, ad basin leviter constricta; discus niger, subopacus, epruinosus, margo parum prominulus, integer, acutuisculus, persistens, gonidia non includens, inferne ex hyphis radiantibus, leptodermaticis et septatis formatus, maculas nigrescentes ibidem offerens, superne nigrescens, KHO obscure violaceus, extus strata tenui amorpho et decolore circumdetus; hypothecium crassum, rufofuscum, lateraliter in marginem fere usque ad verticem hymenii

assurgens, KHO in purpureum vergens; hymenium superne coerulescenti-nigricans, KHO purpureo-violaceum, caeterum decolor, guttulis oleosis non impletum, 80-110 μ altum; asci oblongo-clavati, 8 spori, sporae in ascis biserialis, fuscidulae, oblongae, rectae vel curoulae, diblastae, loculis oblongo-subquadrangularibus, cellulae dimidium fere aequantibus, isthmo tenui junctis, 15-22 μ longae et 3-6 μ latae.

Pycnoconidia ignota.

Corticola.

Accedit ad **Pyxinom coccoes** (Suv.), ab ea differens sporis minoribus et thallo soralibus ornato. A cel. Dr. **G. O. Malme**, qui specimina vidit, pro specie distincta declarata.

Physcia integrata var. **sorediosa** Wain., Etud. Lich. Brasil, Vol. I, 1890, p. 142; Hue in Nouv. Archiv. du Muséum, ser. 4a., Vol. IV, 1900, p. 63, tab. IV, fig. 3. **Physcia integrata** f. **sorediosa** Muell. Arg. in Engler, Botan. Jahrbuch., Vol. XX, 1894, p. 261.

Thallus foliaceus, plagas, usque 10 cm latas formans, subirregularis vel plus minus radiatim crescens vel stellatus et dein magis adpressus et laciniis magis linearibus convexisque circumdatus, albidus, glaucescens vel passim subflavescens, opacus, KHO superne flavens, crebre et irregulariter laciniatus, lacciniis fere imbricatis, brevibus, 1-3 mm longis et 0.5-1.5 mm latis, pleniusculis, ad apicem latioribus, incisis, anguste sinuatis vel crenatis, soralibus rotundis vel subirregularibus, convexis, usque 3 mm latis, pulverulentis, dispersis vel approximatis obsitus, isidiis destitutus, inferne niger et rhizinis nigris vel nigricantibus; ex hyphis longitudinalibus et conglutinatis formatus munitus, utrinque corticatus, cortice superisve fere decolore, 16-30 (40) μ alto, ex hyphis dense inspersis, perpendicularibus et septatis formato, paraplectenchymatico (cellulis parvis, 5.7 μ latis, subrotundis), superne strato tenui amorpho tecto; cortice inferiore fusco-nigrescente, strato corticali superiori paulum angustiore, paraplectenchymatico, cellulis parvis; medulla alba vel albida, K flavens, I-, ex hyphis densis, superficei parallelibus et ramosis, inspersis formata; strato gonidiali infra corticem superiorem sito, continuo, cellulis globosis, 7.10 μ latis.

Apothecia parmelioidea, sessilia, dispersa vel approximata, rotunda vel rotundata, 1-2 mm lata, ad basin leviter constricta, receptaculo laevi, thallo concolore; discus obscure rufus, rarius nigricans, opacus, epruinosus, a concavo subplanus; margo thallinus primum crassiusculus, et inflexus, demum angustior prominulus, thallo concolor, ex integro leviter crenulatus, medullam et gonidia copiosa includens; excipulum integrum, lateraliter usque ad verticem hymenii adscendens et ibidem a margine thallim obtectum, bene evolutum, ex hyphis intricatis, maculis parvis praeditis formatum, I-; epithecium distinctum non evolutum; hymenium superne fuscescens, caeterum decolor, guttulis oleosis non impletum, 110-140 μ altum, coeruleum, paraphyses filiformes, densae, strictae, plus minus conglutinatae, eseptatae, ad apicem constricte articulatae, cellulis 1-2; asci anguste clavati, 8 spori; sporae in ascis biseriales vel subbiseriales, fumoso-

fuscae, subfusiformi-oblongae, ellipsoideo-oblongae vel obovoideae, ad apices angustato-rotundatae vel rotundatae, uniseptatae, loculis parvis, subcornuto-angulosis, isthmo tenui junctis, 20-27 μ longae et 9-12 μ latae.

Pycnoconidia (fide Wainis) cylindrico-oblonga, utrinque obtusa, recta 3 μ longa et 1 μ lata.

Corticola.

MUSCI

One single species of moss was found and collected by the writer on Palmyra. It is the only representative of the mosses, but was unfortunately not in fruit. It was sent on to Dr. Zahlbruckner with the Lichens, but he has made no report on it.

In the interior of some of the islets situated at the eastern end, the trunks of the tall coconut trees are densely clothed with this beautiful bright green moss.

FILICES

POLYPODIACEAE.

Asplenium nidus L. Spec. plant. II (1753) 1079.

Palmyra: Extremely common on all the islets, but mostly terrestrial, also epiphytic. It forms the entire undergrowth in the interior on most of the islets (see plates VI, XII).

On Palmyra this fern, when terrestrial, grows to a height of 6 feet and even taller.

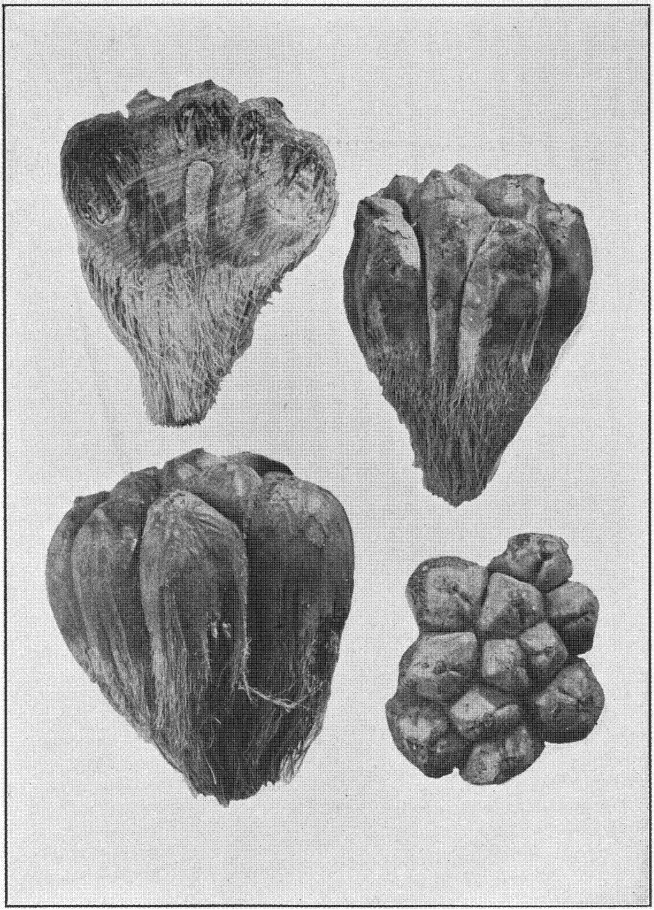
Rock (fruiting July 12-28, 1913) No. 10,280 in College of Hawaii Herbarium.

Polypodium phymatodes Linn. Mantissa plant. (1771) 306.

Palmyra: Not found on all the islets, but very common on Cooper and Holei islets (see plate XI), epiphytic and very large. It is terrestrial on some of the other islets on the loose coral clinkers, but never growing very large (see plate XIX).

Rock and Cooke (fruiting July 28, 1913). No. 10,281 in College of Hawaii Herbarium.

Streets in Bull. 7 of U. S. National Museum, page 143, records *Polypodium aureum* L. from Palmyra and Washington Island. He evidently confused it with *P. phymatodes* L.



Panadanus Rockii Martelli.
slightly reduced.

MONOCOTYLEDONEAE

PANDANACEAE.

By U. Martelli, Florence, Italy.

Pandanus (Keura) **Rockii** Martelli n. sp. plate XV.

A tree 8-10 m high, branching at the apex. Phalanges large, 8 cm long, cuneate, 6 cm broad at the apex, narrowing towards the base, grossly and acutely angled, as a whole pentagonal shaped, the vertex convex, free in the upper third portion and divaricate below, the lateral faces irregularly and acutely angled, narrowly and deeply longitudinally sulcate by the sutures of the locules, locules 11-12, large, the outer ones often somewhat larger, prominent, separated by deep narrow furrows, rounded, pyramidal-hexagonal, subsymmetrical, crowned by the slightly projecting, hyppocrepiform stigmas; endocarp bony, placed partly in the upper half, 3 cm thick, rounded in the upper part, slightly rimose, almost even below.

Habitat: Palmyra, on Holei Islet; collected July, 1913, J. F. Rock.

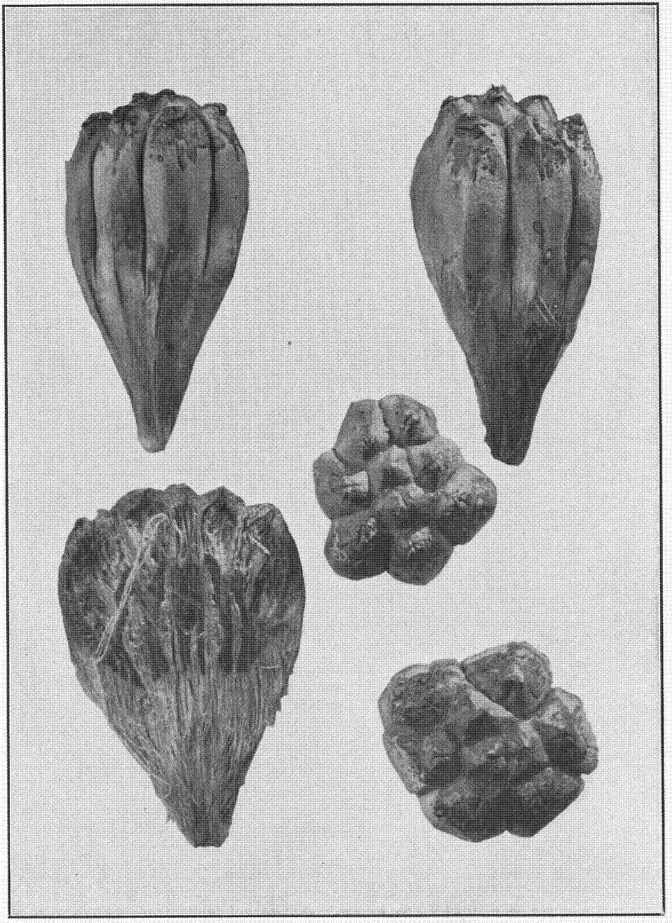
Pandanus (Keura) **pulposus** Martelli var. **Cooperi** n v. plate XVI.

Phalanges turbinate 7-7.5 cm long, gradually attenuate from the middle to the base, 3.5-5 cm in diameter at the middle, somewhat rounded and free towards the apex, convex above, the lateral faces subsymmetrical and acutely angled, with narrow furrows running down longitudinally, forming the sutures of the drupes; locules 8-9, somewhat prominent, pyramidal, stigmas subhyppocrepiform especially on the outer locules, situated on the subrecurved vertex of the locules; endocarp bony, located partly in the upper half, 2.5 cm thick, irregularly rounded above, rimose, convex below.

Habitat: Palmyra Island, H. E. Cooper, 1914.

I have named the above described new species (*P. Rockii*) and the variety of *P. pulposus* in honor of Mr. J. F. Rock and Judge H. E. Cooper, the explorers of Palmyra Island.

The specimens sent to me consist only of a few phalanges of the fruits, which however, are sufficient for identification, and show that the first is very closely allied to *Pandanus carolinianus* and perhaps may be only a local form of it; the other is slightly distinct from the typical plant of *Pandanus pulposus* growing in the Marshall group. The seeds of these plants, I think, have been drifted by currents to the shores of Palmyra Island. In fact, the phalanges of the two Pandani named above belong to the Section *Keura,* which contains the species more adapted to resist for a long time the action of salt water, and which may float to the shores of the coral islands of the Pacific, where the species represent one of the principal elements of the strand flora.



Pandanus pulposus Martelli var. **Cooperi** Martelli.
slightly reduced.

GRAMINEAE

Monerma repens (R. Br.) Beauv Ess. nov. agrostogr. (1812) 117.

Palmyra: on all the islets, on the outskirts of the forests along the beach and on open flats in loose coral, in company with *Lepidium owaihiense Cham.* et Schl., *Fleurya ruderalis* Gaud. and *Boerhaavia tetrandra* Forst. (See plate XIII.)

Rock (flowering and fruiting July 12-28, 1913) No. 10276 in College of Hawaii Herbarium.

Only the young plants have a tendency to grow prostrate; the mature plants are all erect, often 3½ feet in height; the spikelets are less acuminate than in the typical specimens of *Monerma repens*.

It is the only representative of the family Gramineae on Palmyra.

This species has also been reported from Laysan Island.

PALMAE

By O. Beccari (Florence, Italy.)

Cocos nucifera L. sp. pl. II (1753) 1188. forma **palmyrensis.** O Beccari, plates XVII, XVIII.

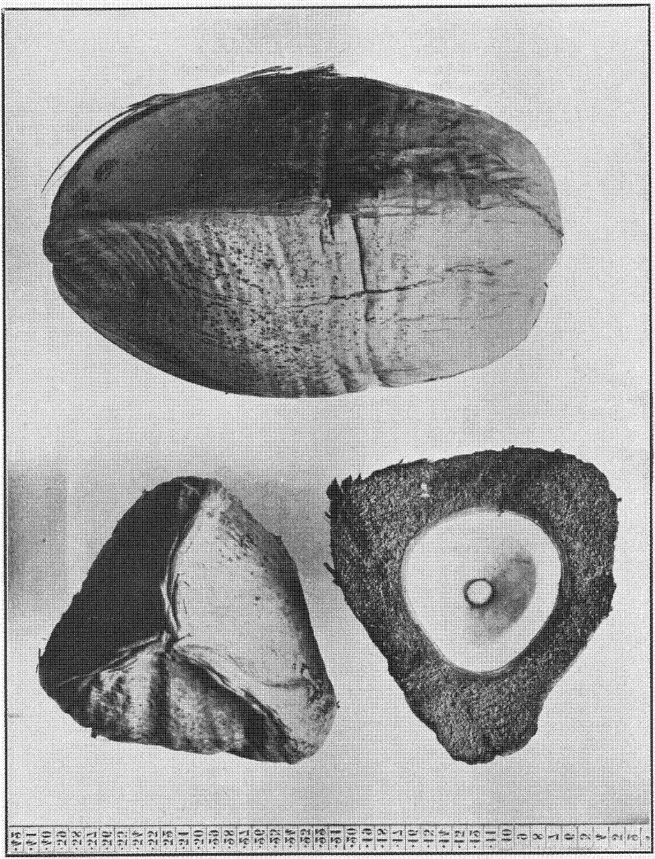
As Mr. Rock has had some fruits of the Palmyra Coconut palm sent to me from Hawaii, I believe that I am able to offer some observations about them which are not without interest.

It cannot be said that the Coconut Palm of the Palmyras constitutes in itself so plainly distinct a variety from any other as to deserve a special name; it simply represents a local form: *palmyrensis.*

The fruits of the Palmyra *Cocos nucifera* are chiefly characterized by their large size, by their length, by their distinctly trigonal shape, especially at their apices, where the three edges almost take the shape of wings and by the great development of their fibrous mesocarp. The external three cornered shape of the fruit is much accentuated even in the nut, and in the seeds, although the angles are less acute; while in nearly all other varieties the nut, and in consequence the seed, present, almost always, a circular transverse section*.

---

* Prudhomme (1e Cocotier, p. 22) mentions a variety of *Cocos nucifera* in the Nicobars which bears very large fruits having nearly the shape of a triangular pyramid; and, on page 30 he speaks of a Madagascar variety having a long shaped fruit, characterized by its 3 well defined ridges running the whole length of the fruit, which is, however, but 25 cm. long, by 17 to 19 cm. in diameter.



Cocos nucifera L. forma palmyrensis Becc.

The size and shape of the Palmyra Coconuts are very variable, from what I can judge by the four fruits sent to me. One of these is very remarkable for its large size and for its extraordinary length. I do not think that I know in any collection of one that surpasses it in this respect. From Dr. Hill, Assistant Director of Kew, I learn that the Museum there possesses two very large coconuts, one of which is quite exceptional in size; it came from the Straits Settlements, and is 11 inches long (279 mm) by 14 inches across (355 mm); the other came from Annam, and measures 11 by 9½ inches (or 279 mm by 24 mm).**

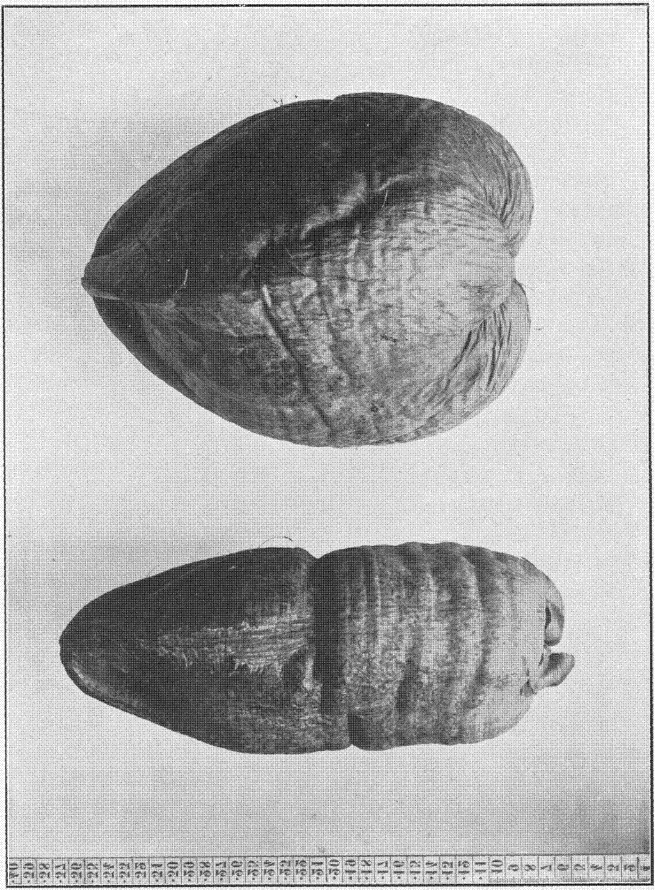
The largest fruit from the Palmyras measures 36 cm. in length by 23 cm. in diameter, and weighs 1715 grams; is elliptical and has three very acute angles; it is rounded at the base, and at the apex shows three very high, almost winglike, ribs or ridges; the side-faces are almost flattened, one, indeed, is slightly concave.

The second in size is almost heart shaped, very large at its base, and terminates in a distinctly pyramidal trigonal point; it has also the 3 very sharp angles; it is 30.5 cm. long by 24.5 cm. wide; it weighs 1133 grams. A third measures 33.5 x 20 cm. and weighs 1440 grams. A fourth has a very singular shape, being very long and slender, with a very acute trigonal pyramidal apex, the angles in the rest of the fruit being rather obtuse; it measures 33.5 cm. in length, but only 13.5 cm. in diameter. On the average these fruits are from 5 to 8 cm. longer than the common coconuts.

In the medial transverse section one fruit (the third mentioned) shows a clear trigonal shape with the mesocarp (the husk or fibrous covering) dense on the sides from 2.5 cm. to 3.5 cm., and 5 cm. to 5.5. cm. on the angles; the endocarp or wall of the shell, is comparatively thin and fragile and is not of uniform thickness throughout, measuring for ⅓ of the periphery 2 to 2.5 mm., and in the remainder, or in that part wherein the traces of the barren cells are included in its substance, measuring 3 to 5.4 mm. The seed is, as I have already said, trigonal in shape, although it has very obtuse angles. The albumen is much more developed than is usual; its walls being 15 mm. thick. As a rule the albumen is considered as very thick when it attains 11 to 12 mm.

It is a well known fact that coconuts float on the waves, but I never thought their specific gravity was so low as it proves to be

** The extraordinary diameter of the first mentioned leads me to suspect that it may be attributed to the development of all 3 of the ovules instead of one only.

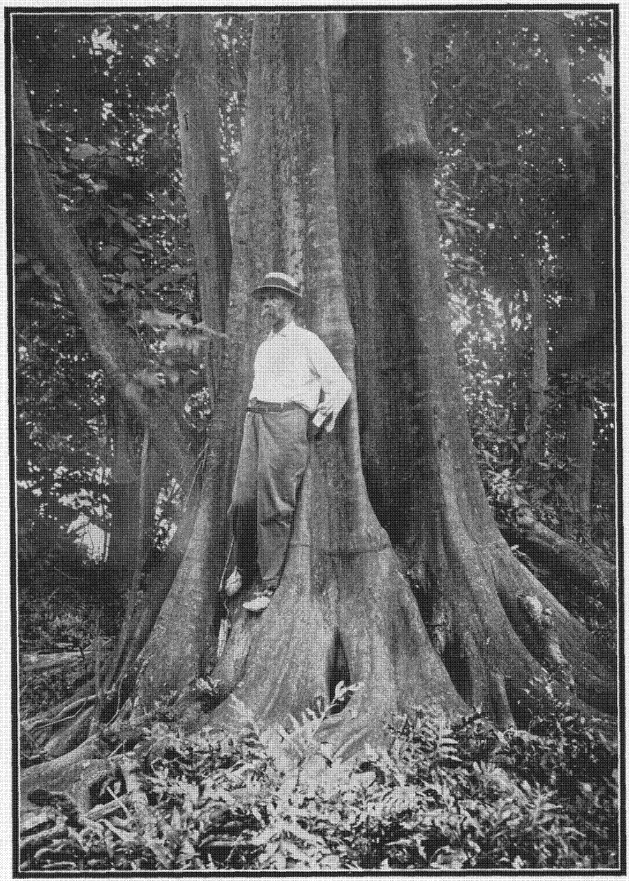


Cocos nucifera L. forma palmyrensis Becc.

with these. The fruits of the Palmyra *Cocos* are trigonal in shape and on immersion in a basin of fresh water floated upon one of its sides on the top of the water, scarcely submerging any portion of its surface. Consider from this how great their buoyancy must be in sea water. Moreover, in floating, the base of the fruit, by which it is attached to the spadix, remains completely raised above the water.

In detaching itself, the fruit, it would seem, sometimes carries away the fruiting perianth, while on others the perianth is left adhering to the branches of the spadix; but in any case the perianth is easily detached from the fruit, leaving the cicatrix of its attachment on the latter. This is the only point of the surface of the pericarp through which water or aqueous vapor can penetrate its interior, all the surface of the pericarp being clothed elsewhere with a strongly resisting and water proof epidermis, on which the usual dots, which I have described on the *Hyphaene* and the *Borassus,* are to be noted. (Webbia, Vol. IV, p. 369). But if the cutinized surface of the pericarp does not permit absorption of water, at the same time it impedes evaporation. In exact correspondence with the cicatrix left by the fall of the perianth is the thinnest part or pore of the shell, to which corresponds also the radicle of the embryo. Between the cicatrix of the perianth and the pore of the shell the mesocarp is thicker than elsewhere, but is formed of longitudinal fibres more slackly united by a spongy tissue than on the periphery, so that the water, or the water vapor, can easily, by capillary action, penetrate at this point to the embryo. If the humidity of either kind happens to be impregnated with salt, the hygroscopic power of this tissue of itself favors the sprouting of the germ. In any case it is undeniable that the fruits of the *Cocos nucifera* can maintain themselves for a long period in a state of potential germination, and, at that, after having long wandered over the surface of the ocean.

In the fruits of the coconut palm the point is the heaviest part, so that when they fall they lie on the ground inclined with their bases pointing uppermost. This too is the position which planters of the coconut palm consider the best to secure germination of the fruit in planting it. Moreover the fruit germinates quite easily even lying on the surface of the ground uncovered with earth. Thus the coconuts, whether they remain uncovered, as when they fall from the parent tree, or, are thrown by the ocean billows on its shores, are placed at once in the position most favorable for their germination.



Pisonia grandis R. Br. The biggest tree on Palmyra; the vegetation of Eastern Islet and Papala Islet consists mainly of this tree with **Polypodium phymatodes** covering the loose coral.

DICOTYLEDONEAE

URTICACEAE.

Fleurya ruderalis (Forst.) Gaud. Bot. Voy. Uranie (1826) 497.

Palmyra: On all the islets, in shaded places along the shores and in the interior of the islets. It is herbaceous throughout, but reaches a height of often more than 4 feet; the ends of its branches as well as the inflorescence are often bright red and very showy; especially common on Home Islet. Rock (flowering and fruiting July 12 to 28, 1913) No. 10282 in College of Hawaii Herbarium.

NYCTAGINACEAE

Boerhaavia tetrandra Forst. f. Florulae insul. austral. prodr. (1786) n. 2.

Palmyra: Common on Cooper and Strawn Islets, scarce or wanting on the other islets. It occurs only on the open loose coral flats, in company with *Lepidium owaihiense* Cham. et Schl. *Fleurya ruderalis* Gaud. and *Monerma repens* (R. Br.) Beauv.

Rock (flowering July 12-29, 1913) No. 10273 in College of Hawaii Herbarium.

Pisonia grandis R. Brown prodr. Florae Nov. Holl. I (1810) 422; icon apud: Endlicher, Iconogr. generum plant. (1838) tab. XXX. Syn. **Pisonia alba** Span et **P. silvestris** T. B.

Palmyra: On all the islets, more or less common; most abundant on Eastern Islet, where it forms practically the sole tree growth (see Plate IX). The tallest tree of this species is eighty feet in height and has a trunk of about 18 feet in circumference. (See Plate XIX.)

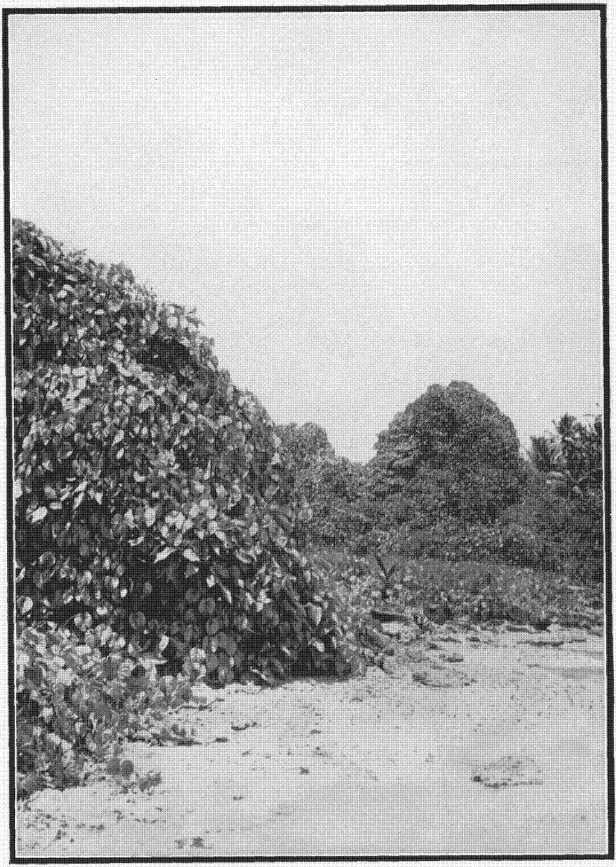
Rock (without flower or fruit July 12-28, 1913) No. 10274, Cooper (flowering and fruiting March, 1914) No. 10275 in College of Hawaii Herbarium.

PORTULACACEAE.

Portulaca oleracea Linn. Spec. plant. I (1753) 445.

Palmyra: Only one single plant observed, growing in the muddy bay (lagoon side) on Holei Islet.

Fl. XX.



Ipomoea glaberrima Bojer. This strong climber covers the tallest trees and has taken complete possession of one of the islets.

CRUCIFERAE.

Lepidium owaihiense Cham. & Schlechtend. in Linnaea I (1826) p. 129-190; Thellung Die Gattung Lepidium (1906) 297; **Lepidium oahuense** Hillebr. Fl. Haw. Isl. (1888) 10.

Palmyra: Common only on Cooper and Strawn's Islets on the open loose coral flats; a bush 1 to 1½ feet high. It is always found in company with *Boerhaavia tetrandra* Forst. and *Fleurya ruderalis* Gaud.

It was first collected on the Island of Oahu by Chamisso in 1816, but has since been found on the island of Laysan and now on Palmyra; it is the only strictly Hawaiian species found on Palmyra. The Hawaiian name of the species is *Anaunau* or *Anounou*.

Rock: (Flowering and fruiting July 12-28, 1913) No. 10277 in College of Hawaii Herbarium; also collected by Streets on Palmyra and Washington Islands, 1873-1874.

SIMARUBACEAE.

Suriana maritima Linn. Spec. Plant. I (1753) 284; Streets in Bull. 7, U. S. Nat. Mus. (1877) 142.

Palmyra: Collected by Streets only on Palmyra and Christmas Islands. Not a sign of this plant was seen by the writer.

APOCYNACEAE.

Ochrosia oppositifolia (Lam.) K. Sch. in Engl. et Prantl Naturl. Pflzfam. IV 2. (1895) 156, fig. K-M. Syn. **Ochrosia borbonica** (Spr.) Gmel. in Linnaeus Syst. nat. II (1791) 439.

Palmyra: On the western end of Holei Islets, forming a dense forest; not observed on the other islets. It reaches a height of 50 feet with trunks of 2 feet in diameter; flowers are whitish and very strongly scented. The tree branches at long internodes in whorls, each branch branching likewise; bark yellowish, rather thin and covered with lenticels. A few trees of *Pisonia grandis* R. Br. of huge dimensions grow in this somber forest of *Ochrosia oppositifolia*.

Rock and Cooke (flowering and fruiting July 25, 1913) No. 10279 in College of Hawaii Herbarium.

CONVOLVULACEAE.

Ipomoea glaberrima Bojer, in Hook. Journ. I (1834) 357.

Palmyra: Very common on Papala Islet; also found on Cooper

and Eastern Islets. On the first mentioned it grows on the shores and covers the *Tournefortia* as well as some of the high *Pisonia* trees (see plate XX). On the last mentioned islet it grows in the interior, where it becomes a large woody climber, its stems intertwining and forming thick rope-like strands. On the lagoon side of one of the islets it covers the *Pisonia* trees, forming a dense broad wall down to the water's edge. Its leaves are deeply cordate; the corolla is white.

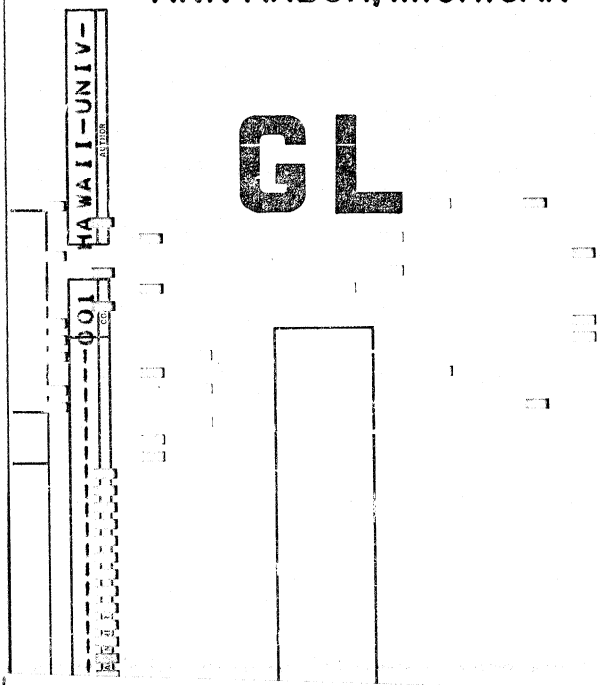
The species has been recorded from Hawaii by Guppy.

BORRAGINACEAE.

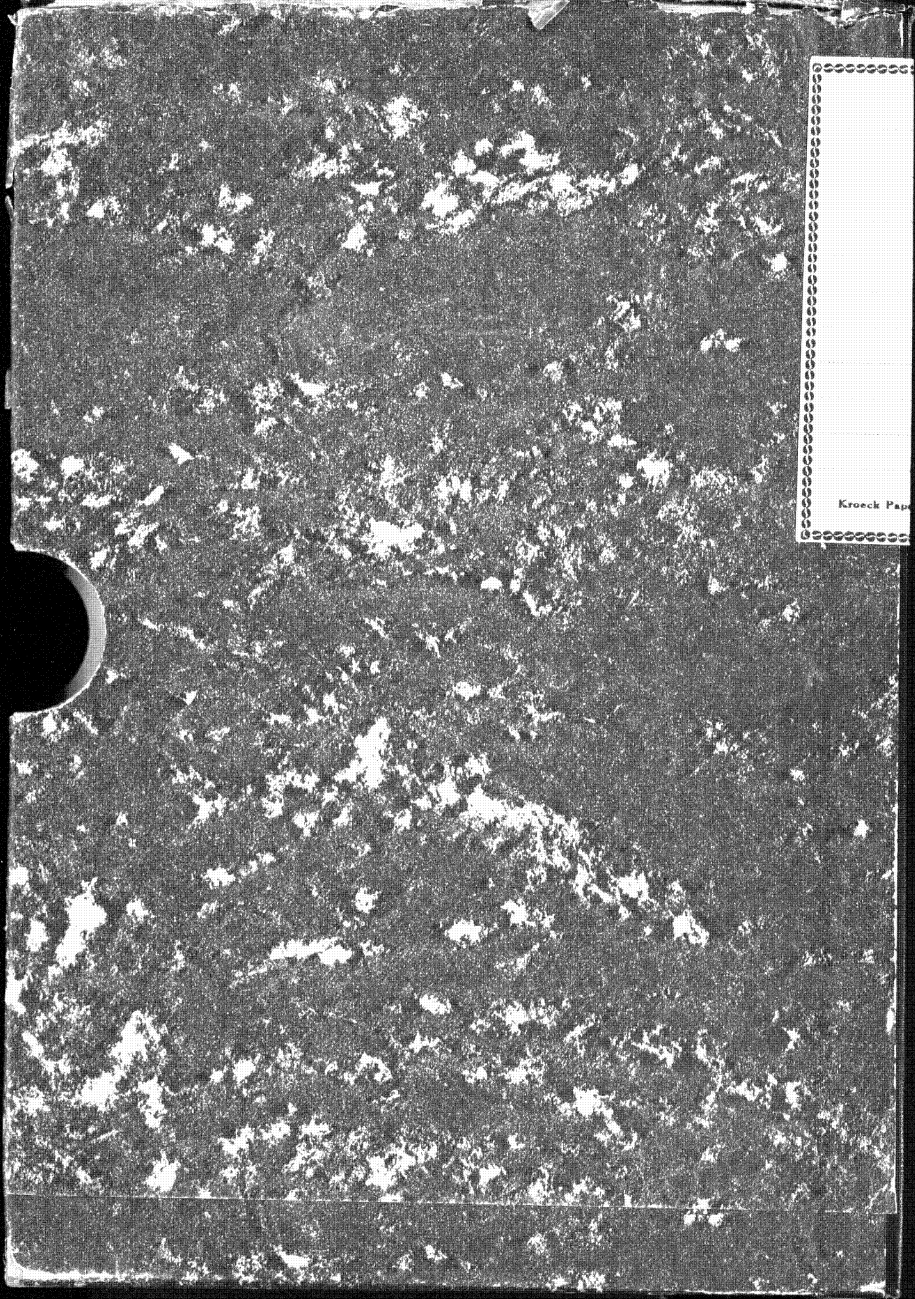
Tournefortia argentea Linn. f. Suppl.. (1781) 133.

Palmyra: The most common tree on all the islets, usually only fringing the shores, but also growing in the interior; along the shores the tree is not taller than 12 to 15 feet (see plate III), while in the interior of the islets it often reaches a height of 40 feet. It then developes trunks of more than a foot in diameter but rarely grows straight, usually branching a few feet above the ground and thus developes several large trunks, which are enclosed in a thick scaly bark, usually covered with lichens. It furnishes the sole firewood of the island.

Rock (flowering and fruiting July 12-28, 1913(No. 10278 in the College of Hawaii Herbarium. The Tahitian name of the tree is *Tahinu*. It is cultivated in the Hawaiian Islands as an ornamental tree.



PRINTED IN U.S.A.
23-520-002


Kroeck Pape